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THE SCOTTISH GEOGRAPHICAL MAGAZINE

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THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

ON THE FORMATION OF WAVE SURFACES IN SAND.

By Vaughan Cornish, M.Sc. (Vict.), F.C.S., F.R.G.S.,
Associate of the Owens College.

(*Illustrated from Photographs taken by the Author.*)

Let us commence by an examination of the little streams which flow across a sandy foreshore to the sea. Where the water is clear, the sand grains are seen to roll and slide along the bottom. In places the sand is in waves, and above each sand wave is a water wave. The wave fronts of sand wave and water wave coincide, and in all cases appear to occupy exactly the same positions as the water waves in streams which have not a sandy bottom. Where the motion of the stream is checked at any point of the bank a standing water wave originates and extends diagonally across and down stream; under this ridge of water is a ridge of sand, which is therefore not at right angles to the direction in which the stream is flowing, but to the line along which its motion is locally checked. This sort of sand wave has no power to grow beyond the limit set by the water wave, and, if the water wave be annulled, the sand wave soon vanishes. The sand waves which we see in the clear water are therefore very different from the waves of the sea and from cloud ripples, which do not depend for their origin or continuance upon a pre-existing intermittence in the flow of the superincumbent fluid. Let us, however, seek a part of the stream where the water is turbid with sand, which is the case where the water flows rapidly. Here the sand waves (which are larger than those we have so far seen) are also surmounted by water waves, but it is soon evident that it is the sand wave which has the mastery of the water wave, and not *vice versa*, as in the previous case. The wave fronts frequently extend quite across the stream, and are at right angles to the current. The velocities in the

streams of tidal foreshores vary rapidly from minute to minute and from point to point. No sooner is the speed attained at which the water becomes thickly charged with sand than long trains of these sand waves[1] arise as if by magic. As soon as the critical speed (? which varies with the depth) is surpassed, it seems that the common surface must be a wave surface. The sudden development, and the wave front at right angles to the flow, indicate that we have here something more like the creation of a "Helmholtz surface,"[2] but the waves travel *up stream*, which Helmholtz waves do not. This motion (which is sufficiently rapid to be strikingly visible) is due[3] to the circumstance that the upper surface of the superincumbent fluid is itself in waves, and that the waves of this surface are near the wave surface of the sand. In deep streams also we have the sand waves under clear water and the sand waves under turbid water. The former are called *current mark*, and seem to me to depend greatly upon the pulsation of the stream, and not to be truly analogous to the Helmholtz wave surface. Of the wave surfaces under turbid water I have studied those produced by tidal currents;[4] they also occur in non-tidal streams, *e.g.* the Mississippi. It is streams of a sufficient depth and of which the velocity is sufficient to keep the lower layers of water highly charged with sand in eddying suspension that the true Helmholtz waves appear to form, grow, and move down stream. The chief difficulty of their investigation is due to the invisibility of the bottom when deep water is turbid with flying sand.

Attention was first called to tidal sand ripples by Osborne Reynolds,[5] who found them submerged in channels between sand banks in estuaries. My observations were on tidal sand ripples which I found above low water (Figs. 1 and 2). They are generally unsymmetrical in form, with the steep face on the sheltered side, as are "current marks" and æolian sand ripples. They apparently do not require for their formation any co-operation between flood and ebb currents, although where such co-operation occurs, the wave fronts probably become less sinuous. They are to be seen not only in tidal estuaries, but also in some localities on the seashore[6] where the sands are exposed to waves as well as to currents, but they face with the current, not with the waves, and are thus readily distinguished from the wave-formed ripple mark. The smallest tidal sand ripples which I have found exposed at low tide were

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[1] See the author's paper on "Kumatology."—*Geogr. Journ.*, June 1899. Plate I. Fig. A.

[2] The expression is Von Baschin's ("Die Entstehung Wellenähnlicher Oberflächenformen, ein Beitrag zur Kymatologie."—*Zeitschr. Ges. Erdk. Berlin*, xxxiv., 1899, pp. 408-424). Helmholtz' papers on waves in air and on water are conveniently accessible in Cleveland Abbe's collected translations of papers on the *Mechanics of the Atmosphere*.

[3] *Geogr. Journ.* loc. cit.

[4] On "Tidal Sand Ripples above Low-Water Mark." A preliminary communication of observations made, January and June 1900, was communicated to Section C British Association, 1900. The detailed account with the measurements is intended for publication in the *Geogr. Journ.*

[5] Reports of Committee appointed to investigate the Action of Waves and Currents on the Beds and Foreshores of Estuaries by means of Working Models.—*British Association Reports* of meetings of 1889, 1890, and 1891.

[6] And on the Goodwin Sands, where I found them, May 12, 1900.

FIG. 1.—Tidal Sand Ridges in the Dovey Estuary.
Photograph taken June 15th, 1900. Wave lengths about 15 feet.

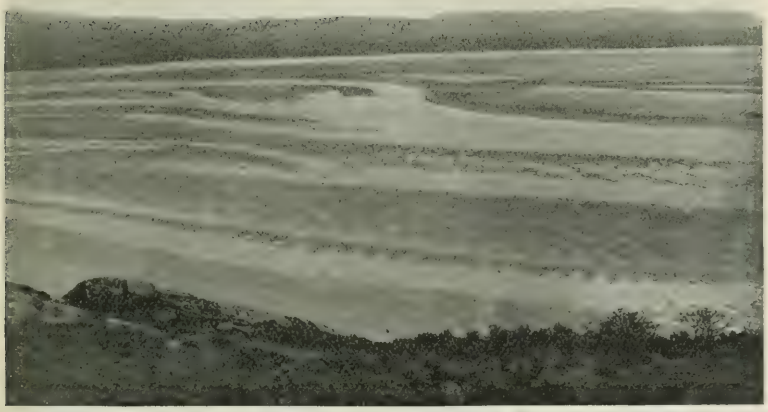

FIG. 2.—Tidal Sand Ridges in the Dovey Estuary.
Photograph taken June 12th, 1900, from elevation of about 300 feet above Trefri Point, looking S. Wave lengths about 25 feet.

FIG. 3.—Ripple Mark in Quadrilaterals, two sets of parallel ridges simultaneously produced by waves.

Photograph taken at Grange, Lancashire, Jan. 27th, 1900. *The stick in foreground is 3 feet long.*

FIG. 4—Tidal Sand Ridges on the Dun Sands, two sets of ridges successively formed by currents.

Photograph taken April 28th, 1900.

3 feet from crest to crest, and all sizes from this to 20 feet wave length are common. On the Dun Sands, in the Severn, below the junction with the Wye, the average wave length (L) of fifteen consecutive ripples was 37′ 8·5″, and the average amplitude (H) was about 1′ 10·5″, giving a ratio L/H = 20. This ratio varies much according to whether the tides are increasing or diminishing, and is sometimes as small as L/H = 14. On a sand bank in the Dovey estuary (North Wales), opposite to the town of Aberdovey, I marked out a plot with stakes driven deeply into the sand, and recorded by daily measurements the increase, diminution, and march of the sand waves. At neap tides the sands were nearly smooth, and as the tides increased the tidal sand ripples appeared, short and relatively steep. The amplitude increased steadily, the average wave length also increased, apparently by elimination of some of the ridges. When the highest spring tide was passed the amplitude rapidly diminished, the wave length remaining nearly, but not quite, constant, and the mean sand level remaining practically unchanged. The circumstances favourable to the formation and preservation of tidal sand ripples above low-water mark are, gentle current at first of the flood and last of the ebb, and strong current when the water is deep over the sands. I have often watched the course of events when the last of the ebb has been running over the ridges. The process is then one of decay, not of growth, the sand being swept from the crests into the troughs. What goes on during the *growth* of the ridges? Let the depth of water be sufficient; then, if the velocity of the current be small, the sand grains roll and slide along the bottom, but, as the speed increases, the water, almost suddenly, becomes highly charged with sand in "eddying suspension." A uniform current flowing swiftly over extensive sands picks up as much sand as it drops, thus causing a drift of sand which on the whole is uniform, neither raising nor lowering the bed.[1] My observations indicate, however, that *in detail* the drift is not uniform, but attended by alternate silt and scour along lines at right angles to the current and equi-distant from one another, the surface of the sand bank being thus carved into transverse ridge and furrow without change of mean level. The slightest convexity of surface causes a convergence of currents, a concavity a divergence, and, under the conditions specified, deposition occurs upon the convexities, whilst the concavities are scoured. The vertical inequalities are thus increased,[2] and it is easy to see that the ridges will extend themselves laterally.[3] Thus the ridge and furrow inevitably form and grow. What then are the limits of this growth? Obviously the depth of water is one limit. When the cross section of the stream above the sand ridge is reduced by

[1] *British Association Report*, Manchester meeting (1887). Osborne Reynolds on "Certain Laws relating to the Régime of Rivers and Estuaries and on the Possibility of Experiments on a small scale."

[2] Compare G. H. Darwin's observation of the sand creeping up both sides of a ridge when a current was caused to flow over it.—*Proc. Roy. Soc.*, vol. xxxvi., 1883: "On Ripple Mark."

[3] Compare James Thompson on the "Winding of Rivers in Alluvial Plains."—*Proc. Roy. Soc.*, 1876 and 1877.

FIG. 5.—Current Mark upon Tidal Sand Ridges.
Photograph taken June 15th, 1900, in the Dovey Estuary.

FIG. 6.—Small Sand Dunes in the dry Nile bed near Helwan.
Photograph taken May 8th, 1899. Wave length about 30 feet.

a certain amount, the greater force of water there removes the sand as quickly as it is brought, and further growth is thus stopped. If the depth be further reduced, *e.g.* during an ebbing tide, the ridges decay. In deep water the height of the ridges is limited to that at which the velocity of the stream can maintain an active eddy on the lee of the ridge, and if the velocity be reduced the troughs silt up owing to the sand falling into dead water. It is probable also that the amplitude is some-

FIG. 7.—Æolian Sand Ripples.

Photograph taken at Montrose, N.B., March 11th, 1900. *Wave length about* $2\frac{1}{4}$ *inches, average uninterrupted lateral extension of ridges about* 5 *feet.*

times restricted by the velocity of the current surpassing the limit suitable to the fineness or lightness of the material of which the ridges are composed. For it is evident that there is a difference between the pressure upon the weather side and upon the lee side of a ridge. I notice when wading on sand banks ridged with tidal sand ripples that the pressure of one's tread often causes a bodily sliding of the sand from trough to crest. The growth and even the maintenance of the ripples demands a *differential* movement of the material. There must be a part to stand fast as well as a part to be redistributed. Thus a moderate range in the

sizes of the particles of the loose granular material is favourable to the formation and retention of a wavy surface through a considerable range of velocity of the inducing fluid. It is evident that two sets of crossing ridges cannot be simultaneously produced by true current action, and, in fact, crossing tidal sand ripples are seldom seen. Sometimes, when the direction of current has suddenly changed at a particular time of tide, two sets of ridges are successively formed (Figs. 3 and 4). The "tidal sand ripples" seem, in fact, to be true current-formed sand waves. They are themselves rippled over with "current mark," which is more properly a ripple, in that (like capillary ripples) it only goes skin-deep (Fig. 5). It seems to be due rather to the pulsations of a current than to the current

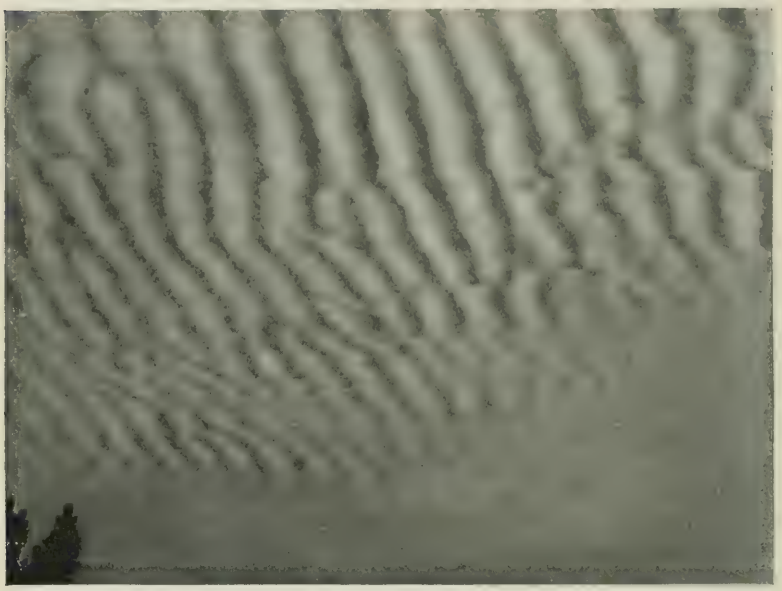

FIG. 8.—Rippled Clouds.
Photograph taken Aug. 5th, 1900, *near Bournemouth*, 5.15 *p.m.*, *looking S.*

as such. I have often seen little sand ripples in fairly deep rapid streams, which I suppose would properly be called current mark, facing obliquely or transversely to the direction in which the sand was travelling. This was near the shore where the most marked pulsation was shorewards.

I have described elsewhere[1] some little dunes formed by the wind out of the very fine and light sand of the Nile bed, when the river was at its lowest (Fig. 6). These dunes, which in size and shape somewhat resembled tidal sand ridges, were covered with a beautiful tracery of little ripples. In the formation of the æolian sand ripples the hetero-

[1] "On Desert Sand Dunes Bordering the Nile Delta."—*Geogr. Journ.*, January 1900.

geneity of the sand[1] plays a much more important, the pulsation of the fluid a much less important part, than in the case of the current mark of streams. I have one more observation on this point to add to those already published. I noticed, during strong winds lasting several days, at Montrose, N.B., March 1900 (Fig. 7), that the rippling of the remarkably uniform dry drifting sand was very slow in beginning. As soon, however, as there was a fair supply of the coarser kind of sand grains aggregated together, the rippling action went on vigorously and rapidly. A moderate range of sizes of material, *e.g.* fine sand and coarse sand, is best for æolian rippling. In the vicinity of big stones the scour of the wind is too great. Since I saw the ripples and dunes on this Nile foreland I have not thought[2] that the ripple in loose dry sand can itself grow into a dune, but have regarded them as being two orders of undulation, as are the capillary ripple and the storm wave of the sea. During the occasions on which I visited this little dune tract the strong breeze drifted the fine light sand thickly near the surface, and in the afternoons there was a haze of flying sand extending 20-30 feet above the foreland. The conditions were in fact very similar to those with which I have since become familiar in the case of formation of tidal sand ripples. It seems highly probable that the fine, light sand in this wind was in a condition similar to the "eddying suspension" of water drift, proceeding in the manner described by Osborne Reynolds, plus the rapid increase of slight inequalities forming waves, as above described. The same brisk breezes which were forming dunes as regular trains of sand waves, as high as the quantity of dry Nile sand permitted, were not able to deal in the same free fashion with the coarse quartz sand of the larger desert dunes west and east of the Delta. Dunes are by no means always "free" sand waves, and there are many complications, due *e.g.* to the firmness and coherence acquired by sand when stationary for a time in large masses, especially in presence of moisture. Dr. Sven Hedin's experiences, however, during high winds in the worst parts of the Takla Makan desert seem to accord very well with the conditions of what Von Baschin calls a Helmholtz wave surface when the inducing fluid is driving forward a train of waves of about the maximum dimensions. The conditions would be very similar for one of Charles Kingsley's "Water Babies," who might find himself amongst the ridges on the Dun Sands when the tide was running strongly.

Note on Photographing Aërial Ripple Mark.

Fig. 8 is reproduced from a photograph which I took of some remarkable ripple clouds, at Branksome Cliff, near Bournemouth, on August 5, 1900, at about 5.15 P.M. The camera was pointed south; the sun of course is on the right, and the shadow of each cloud can be seen on the right-hand edge of the next one. These clouds were drifting rapidly to the east (left), the breeze at the ground level blowing towards

[1] The author, "On the Formation of Sand Dunes."—*Geogr. Journ.*, March 1897.

[2] *Geogr. Journ.*, January 1900, p. 22, line 5.

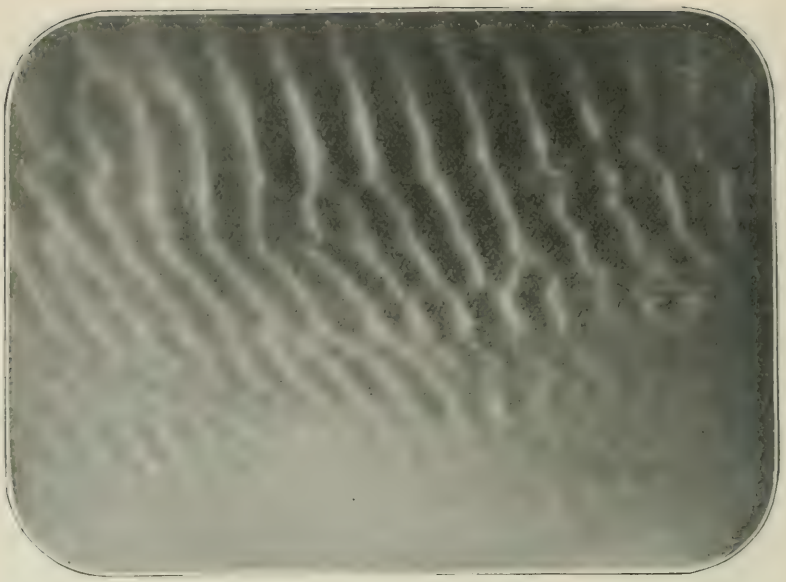

FIG. 9.—The true Aërial Ripple Mark.
This is the negative of Fig. 8, *and shows the ridges of still air between the whirling air of the clouds.*

FIG. 10.—Ripple Mark of the Strand.
Photograph taken at Montrose, N.B., March 10*th*, 1900.

the same direction. Ruskin wrote[1] long since of vapour "falling into ripples like sand." The general likeness is indeed striking, but the differences of detail are also noticeable; which is not to be wondered at, seeing that the cloud ripples are not the counterpart of the rippled sand but of the whirling water between the sand ridges. How then shall we see the form of the aërial ripple mark where there is nought but the blue sky? Simply by reproducing our photograph as a negative (Fig. 9). With this compare Fig. 10, an ordinary (positive) of the wave-formed ripple mark of the strand, taken at Montrose, N.B., March 1900. Note the astonishing similarity of the sharp topped ridges of still air (which project upwards from the lower air layer, between the revolving cores where the clouds are) to the knife-edged ridges of the sand. But most remarkable of all is the precise correspondence of the confluence of ridges, wherever the wave length of the ripple mark is about to change *per saltum* (for the wave length of ripple mark increases in "multiple proportion," three ridges merging into two). And here our sky photographs are superior to, and throw light upon, our sand ripple mark photograph; for the latter had to be taken when the rippling action had ceased and the troughs were no longer filled with whirling water. Fig. 8, however, indicates what is going on where the ripple ridges are being merged, for the lights and shadows of the cloud indicate the activities of the working parts of the system. The rippled cloud here photographed, and consequently the true air ripples also, are symmetrical. This is not always the case, the clouds are often opaque (thick) at one edge and transparent (thin) at the other.[2] In this case the form of the aërial ripple mark must be more like that of current mark, of æolian sand ripples, and of tidal sand ripples.

FROM PARA TO MANAOS: A TRIP UP THE LOWER AMAZON.

By Reginald Kœttlitz.

There has for a considerable time—for the last thirty or more years—been a steady and remunerative trade carried on between Liverpool and Northern Brazil.

Two British companies, owning the Booth and Red Cross lines of steamships, have during that time sent ocean-going vessels to trade with the towns upon the northern coast as well as up the Amazon river.

For long, Manaos, a town situated nearly a thousand miles up the river, was the limit to which their ships ascended; but now they have regularly monthly steamers which run from Liverpool and ascend it as far as Iquitos, in Peru, a distance from the mouth of the river of over two thousand one hundred miles.

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[1] *Modern Painters*, Vol. v., Part vii. chap. i.

[2] The author, in *Knowledge*, October 1896, article "Rippling."

Having a wish to see this famous stream—the most magnificent, in the volume of water it brings to the sea, and second only, in point of length, of any river in the world—as well as some time at disposal, I took an opportunity offered me last April, of going, in one of the Red Cross line of steamships, for the trip to Manaos, which trip also included a voyage thence, through the West Indies to New York, and back again by the route by which we had gone out.

Though the opportunities for studying the people, especially the Indians, as well as the natural history of north-eastern Brazil and the lower Amazon were very few, I propose to give a short account of facts

Sailing and Fishing Boats. Para River.

observed, together with information gathered during the South American portion of this voyage, in the hope that some of the matter may be of interest to the members of the Scottish Geographical Society, and some possibly even new.

After a run of ten days almost directly south-west from Madeira, the low-lying land of the Brazilian coast is approached at Salinas, some distance east of the mouth of the Tocantins river, or eastern mouth of the Amazon, as it is sometimes called. Here a lightship is stationed, and here also the pilot is always taken on board from the pilot schooner which lies off this point for the purpose.

The navigation from here to Para, our first port, becomes somewhat intricate because of the banks, which are formed by the mass of material

brought down by the rivers, continually changing in position; indeed, the whole of this northern coast, being low-lying and very imperfectly surveyed, necessitates a wide berth being given it by a ship, and without a pilot causes the skipper to have a somewhat anxious time there. Wrecks are far from infrequent.

Steaming west along, and at some distance from, the coast for some hours, the Tocantins river mouth is reached and entered; soon the land on the east or right side becomes increasingly distinct: fishing-craft, canoe-shaped, of small and characteristically Portuguese-Brazilian type, appear; details upon the land show up; huts, houses, and small settlements, seeming nearly buried in the luxuriant forest growth which already clothes the banks down to the water's edge, dot the shore; then on the left side the margin of the low-lying and marshy island of Marajo can be traced, and soon becomes more distinct; then smaller islands all covered with forest are passed. On the right bank the houses and settlements become more and more numerous; some of these now have wooden piers jutting into the river, alongside of which steam ferry-boats and small river steamboats are lying and landing their human and other freight; these, also supplied with pleasure buildings and bathing facilities, are the watering-places and pleasure resorts of the inhabitants of Para; they announce to us that we are rapidly approaching this important town. After anchoring off one of the islands some twenty miles north of Para, the quarantine station, and receiving the health authorities, we proceed for a time up the Para river, a waterway and branch of the Tocantins, some two to three miles broad, bounded on the right by a maze of islands and by the mainland on the other, all luxuriantly wooded. Para comes in sight; we pass the small primitive stone fort upon a small rock on the left, five miles below the town, where a shot would stop us had we not the health flag flying, and soon anchor two to three miles below it.

In former times, within the last thirty years, ships could lie close to the town, but now the Para river has become so silted up that there is not sufficient depth of water for a ship of three fathoms draught.

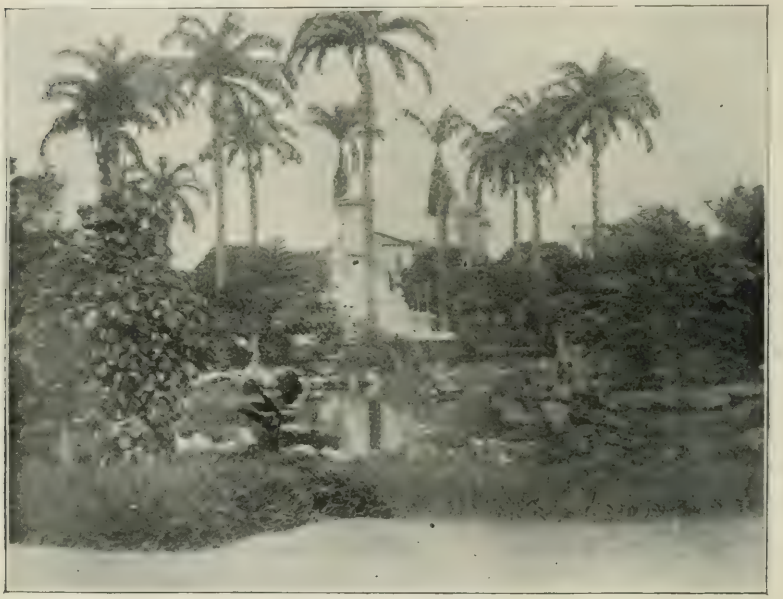
Again—often after great delay—we receive the visit of the sanitary authorities; the customs and other officials follow, after which passengers may land. This has to be done in small sailing or rowing boats, or else in a passenger barge, or lighter, which is towed up the river by a steam-launch or tug; but it is only after endless vexation, worry, and delay of sometimes days—which is considerably lessened if resort is had to bribery—that the long-suffering new-comer can get his baggage passed through the Custom-house, for these (and in fact all other) Government officials are such a self-important, lazy lot of people that private individuals are at their mercy, and consequently imposed upon by these people, whose morals are very elastic.

Belem or Para, the capital of the large state of Para, is an important town, situated upon the Para river about a degree and a half south of the equator, having an estimated fluctuating population of some eighty to one hundred thousand. The site, reclaimed from the forest, is a slightly undulating flat, apparently composed entirely of river alluvium.

The temperature is equable and far from excessive, when its proximity to the equator is considered, for it ranges between 78·0° and 90·0° Fahr., being rarely, I believe, much below the former, or much above the latter; this fortunate condition is brought about, for the most part, by the cool sea breezes which blow so frequently from the north-east and east.

The houses and buildings are considerable in number, substantial and well built; some, indeed, of the public erections being handsome and imposing edifices.

The common building material is in large part a peculiar porous, honey-combed brick, the bricks for which are made in the vicinity: the



Public Garden at Para.

stone and bricks for any buildings which are more substantial have to be imported, largely from Europe—so also are the paving-stones for the streets. These, at least many of them, are well paved; some, the older ones, are somewhat narrow, but many of the newer are fine and broad, and also, for the most part, planted with fine trees—mango and palm principally.

There are several small public gardens and fine plazas within the town, which are well cared for, while in the suburbs are parks and other pleasure resorts. A fine theatre decorates one, and public monuments others, of these plazas. The town is rapidly developing, and the suburbs are being laid out well and fine residential buildings erected in the principal streets. A good and frequent service of tramcars facilitates

rapid transit from one part of the town to another, but they are small, dirty-looking, and often crowded. Mules are, at present, entirely used for traction power there.

Paper is almost the only currency; a few large nickel and copper coins are occasionally met with. This paper money, made in the United States of North America, is so long in circulation that it is almost always, (especially the smaller values, such as 100, 500, 1000, 5000 and 10,000 *reis*), in a very filthy, dilapidated condition, so much so that the values are scarcely decipherable; these the people—tram-conductors, one especially notices—do not hesitate to hold in the teeth and lips, and must be a fertile source of contagious disease. Tram-tickets, which are for the most part made with tough paper, are used over and over again, and also pass as smaller value currency.

The people are a mixed and heterogeneous lot: Whites (principally Portuguese and Brazilians of Portuguese origin, of the darker south European variety), through all shades of yellow and brown, to black. Most of these are half-breeds, crosses between Portuguese and Indian, Indian and Negro, White and Negro, together with mixtures in infinite variety and tenuity of all of these. The hair is also correspondingly variously textured; though universally dark in colour, one sees the lank and straight, the wavy, curly, and all degree of frizziness down to the Negro's woolly pate.

Presumably on account of the predominance among the population of persons with some degree of colour, no disability is caused by colour, all men being esteemed alike there, irrespective of shade of skin.

With this variety in shade, so also a corresponding mixture and variety in feature is in evidence: the long prognathous face and flat, spread nose of negroid type, and the broad, high cheek-boned and somewhat Mongolian cast of countenance of the Indian are very frequently seen, so that it is quite interesting to stand in the streets and examine the passers-by.

The population of Para is, as already mentioned, estimated at some eighty to one hundred thousand; no census has, with any degree of correctness, ever been taken, all Governmental and official work being of the loosest character. In number, however, it is continually fluctuating, because of the large influx of immigrants from Europe, as well as arrivals from other parts of Brazil, especially from Ceara, a place on the north coast; these also are continually leaving again to pass on to the stations up the main river and its tributaries. A short line of railway, which runs some eighty to ninety miles to Bragança upon the coast, is the only means of travelling any distance otherwise than by boat.

There is a fairly regular and frequent service of steam-boats, which run along the coast to the south, as well as up the rivers; these, however, have, by legal enactments, been obliged to be under Brazilian management, or at least under the Brazilian flag; the result is that they, for the most part, do not pay; the accommodation is deplorable, the boats being frequently very much overcrowded, and dirt—largely because of the filthy habits of the people, even those of the better classes—reigns supreme, with the frequent and natural result, especially

upon the river boats, that the deaths on board during a single run can be counted by scores, and sometimes even by hundreds.

Fevers, both yellow and malarial, are very common, and the former especially causes much mortality among Europeans and Americans, particularly the new arrivals. The trade of Para, especially its export, is mostly in the hands of foreigners—German, British, and American; these have commodious offices and warehouses there. Its principal, almost sole, export is rubber, and one may say its very existence depends upon this valuable commodity: but nuts, cocoa, and other vegetable products are also exported to some extent.

Its imports are general goods, in great part manufactured articles

Baraca or Seringueiro's hut. "The Narrows."

and food, with the consequent result that all necessaries are dear there, and living very expensive. Practically no agriculture whatever is practised in this part of Brazil, though a little stock-farming and cocoa-growing is carried on up the river.

Though possessed of a fair port, the shipping facilities are poor, almost all having to be done by the help of lighters; these are frequently, however, not available, although a fleet of them is kept by the companies who trade there; this again is due to the dilatoriness of the Customs authorities. I saw some eighty 100-ton, or more, lighters lying there for the three weeks I was there at one time, waiting to be overhauled by them; months often elapse before they are attended to. This want of lighters causes ocean-going steamships to have to lie there as

long as three weeks sometimes, instead of the five days they would take to discharge, and is injuring the trade of the place, for perishable goods are frequently worthless when at last they are passed by the Customs.

Hotels, more or less primitive, are fairly numerous, but the accommodation is far from luxurious, nor are the sanitary arrangements perfect. The sanitary conditions of the place are very imperfect, and the water-supply, though said to be good, is frequently insufficient when rain is scarce; this naturally tends very greatly to increase the percentage of mortality, which is however unknown, and the people there delude themselves with the idea that it is low! The town is well lit by means of electric light.

Somewhat like the Portuguese, but more pronounced, is the fondness of the people of Para for fireworks; every evening, and frequently during the day even, rockets are fired off in large numbers, for fireworks of the noisier kinds are the greater favourites. Local *festas* with drinking and dancing are very commonly celebrated, and anything gives an excuse for a cheap firework display.

A habit which strikes the visitor to Brazil as very peculiar is the manner which the military have of changing guard at the numerous Government buildings where sentries are posted, for it is accompanied by a savage, ear-piercing yell, which without doubt is a copy of the Indian war-whoop.

After leaving Para one passes through the maze of low, densely wooded islands which lie at the confluence of the Para and the main Tocantin river. Turning into it, one ascends for a short while, some four or five hours, and then diverges to the right or west, and passing through ever-narrowing channels, at last, about twelve hours from Para, enters "the Narrows." Here the country, like that passed through already, is still apparently dead flat, and densely covered with tropical forest. Many islands of all sizes have been passed, but now the way lies through an archipelago of alluvial islands, separated from one another by only such narrow channels that it not infrequently appears inexplicable that there should be depth enough of water in them for ocean-going steamers of more than two thousand tons and eighteen feet and more draught to be able to navigate and pass through them. These channels are so intricate that only a pilot of long training can find his way through them, for there are apparently no vestiges of the slightest landmark. Soon after entering the Narrows we pass Breves, the principal settlement upon the Island of Marajo, where all the rubber upon the island and surrounding district is brought to be sent to Para and exported.

When passing through these narrow channels upon the high deck of a large steamer, the glorious prospect of the tropical forest in all its grandeur can best be seen, and one can begin to realise somewhat how vigorously tropical vegetation grows, and how keen the battle of life is. Emerging from a dense, tangled, almost impenetrable undergrowth, which covers and conceals the ground down to the water, which it also far overhangs, are the trees, many of them in full and gorgeous bloom. First in point of beauty, prominence, and, to the

visitor, in point of interest, are the elegant and graceful palms, which so frequently overtop and tower above the rest: the delicate-looking, feathery Assyee palm, with its abundance of small, hard fruit, the heavier cocoa-nut, besides numerous other kinds, many of which can be readily distinguished from one another, together with numbers very much alike, yet of different species and varying in commercial value, all charm the eye.

Then the cedars, the acacias, the rubber- and Brazilian nut-trees, as well as numerous others which appear more like those familiar to the European, produce infinite variety. These again are frequently covered from base to summit with tangled, hanging creepers which, though to the eye they remarkably improve and beautify the whole,

Manaos—Rio Negro. Part of Town from the River.

are the enemies of, and often destroy, the trees. Many of these creepers also have fine blooms, and so too have the numerous parasites and epiphytes which are settled in the angles and cling to the branches of many of them; then the lichen-covered trunks and fantastically festooned limbs, the lichen- and fungus-grown dead trees and fallen branches—all present a picture of chaotic disorder, wild confusion, fierce strife, as well as of remarkable beauty, which must be seen to be appreciated. Even the water itself is invaded, and the surface along the shore is fringed for yards into the stream with long-stalked luxuriantly green grass and water-weeds, with the tops only out of the water and looking like meadow, but which rise and fall with the waves caused by the powerful wash of the ship as it passes along.

This is the home of the locally so-called "sea-cow" or manatee. Here this silent, harmless, shy, but uncouth-looking beast leads its monotonous and uneventful life, never showing itself, but hidden under water or under the vegetation about the banks. Floating about loose are also patches of this grass-like water-weed, both here and on the main river.

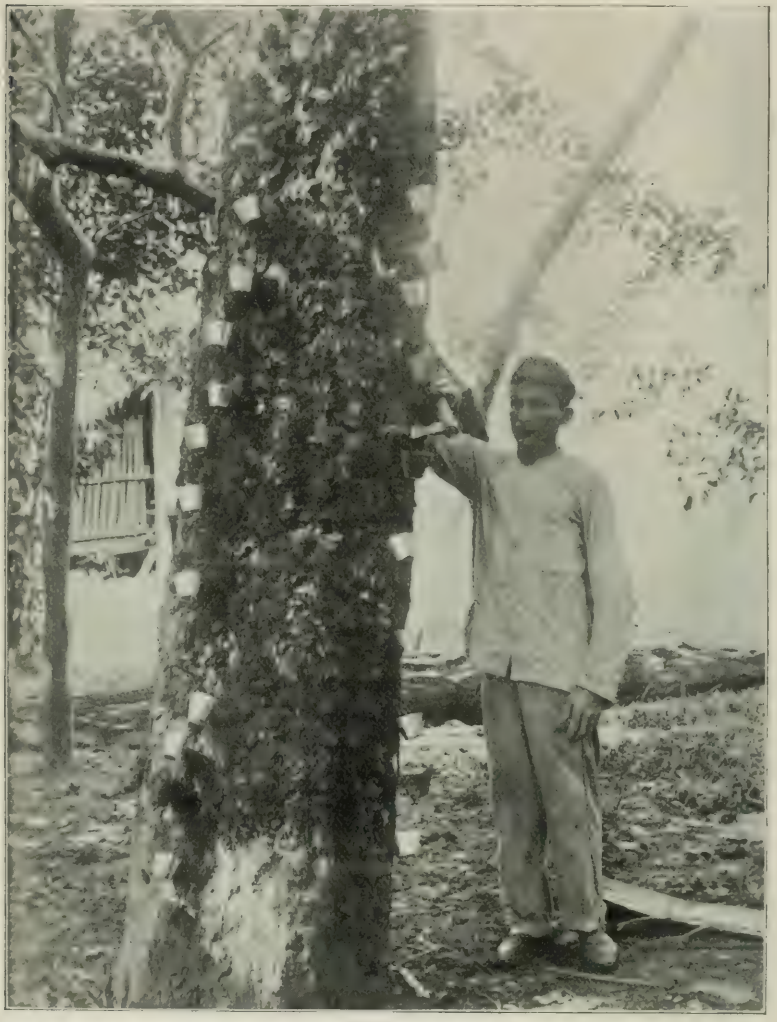
This portion of the country is one of the parts where rubber-trees are plentiful. This is by no means the case everywhere in this country, for though the land is apparently alike in every way, the trees are limited to certain areas. No doubt there are good reasons for this, but these have not yet, as far as I have heard, been elucidated. Rubber hunters' or *Seringueiros'* huts, or *baracas*, therefore dot the banks at fairly frequent intervals; they are situated in small clearings made for the purpose, and just above the water's edge—at least they were in that position at the time of my visit, for this time was during the so-called rainy season, when the river was high. They are raised some feet above the swampy soil by means of short posts, upon which a rude platform is laid, and upon this the hut is built. The inundations which the annual rising of the river causes renders this a necessary precaution. Not infrequently, indeed, the water rises to such a height as to cover these platforms, and compels the family to take refuge in their canoes, of which they have always a sufficient supply; for all extended locomotion has to be performed upon the water by means of these canoes, as the forest being more or less impenetrable and marshy, no paths or roads have been made, except about the immediate neighbourhood of each rubber hunter's labours.

The huts or *baracas* are oblong, commonly simply made with poles and sticks among which the broad leaves of a particular palm are attached and interlaced to form walls, while these support the gable-ended sloping roof, also thatched with the same broad palm leaf. Half, or more than half, of the space covered by the roof is generally left without walls and open all round; the other half has no chimney, though closed by a middle wall from the open half, and what windows there are, as well as the door, open towards the unwalled portion. In this latter portion the family seems to spend the larger portion of its life when at home. Here the cooking and other household work is done. Suspended from the poles which support the roof one can always see the *raidies* or native cotton hammocks, in which the inmates sleep, sit, and lounge, for they are in almost continuous use during the day also. Very little other furniture or utensils are perceptible.

The Brazilian rarely sleeps in a bed, and always prefers to rest where the wind and the breezes can have free play. The life which these people lead is a rather isolated one; it is also far from healthy, and malaria plays great havoc among them.

They are, on this lower portion of the river especially, for the most part of Portuguese ancestry or Portuguese and Indian half-breeds; for Indians of purer blood have more or less disappeared here, and are only to be found farther up the river and in less accessible parts of the country. These rubber hunters are very addicted to drinking *cashasse*, the spirit—a raw rum—made in large quantities in the country.

The method by which the *seringueiro* extracts the juice or latex from the tree, and coagulates it into rubber, may be of interest, so I will briefly relate it.



Seringueiro, machette in hand. Prepared Rubber-tree showing arrangement of cups upon it collecting the latex.

Having found his trees and connected them by means of a path cut through the undergrowth, so that upon each path or *estrada* (for he has several) one hundred or more rubber-yielding trees can be approached,—in the early morning during the season, which is the drier half of the

year—August till January—when the forest is not flooded, he sallies out to make his round, and, *machete* or small-bladed light axe in hand, he visits each tree in turn, and by light blows of his *machete* he proceeds to tap the tree by oblique incision, not too deep, into the bark. This he does in many places upon the trunk, each place having a pair of wounds arranged in a small V shape. Having done this, he takes a small tin cup from a number he has already deposited near each tree and hangs it under each pair of wounds, so as to catch the white cream-like latex or juice which exudes, and which runs for about four hours before it stops; the arrangement is well seen in the illustration. Having completed his round, he returns to his hut. Towards noon he sallies out once more, this time taking with him a vessel into which, after visiting each tree again, he empties the contents of the cups. Thus laden he again betakes himself to the hut, where over a fire he proceeds to evaporate and smoke the juice. This is done by means of a paddle-shaped stick which he holds in one hand, and over which with the other, by means of a cocoa-nut shell, he dips out and pours some of the juice; then revolves this stick with adhering latex over the fire, till the watery portion becomes evaporated; more juice is poured upon it, again evaporated; and thus the process continues until the whole of the liquid is exhausted, with the result that a ball of solid india-rubber is adhering to the stick. When the ball of rubber is large enough, the stick is removed and the rubber is sold to the trader when he visits him for the purpose. The best rubber is obtained from the *Hevea Braziliensis* tree, but there are other trees which also yield rubber, but of poorer quality.[1]

Of animal life here, nothing but the very occasional howls of a pack of monkeys and the screechings of a flock of parrots, as well as the odd note of other birds, with an occasional glimpse of a vulture or a few partridges, gave any evidence that these forests are inhabited by anything living except insects. These sounds and glimpses are, however, comparatively rare, and most of the time a monotonous and brooding silence reigns supreme both night and day.

Insects are, however, everywhere well to the fore at all times. The night is enlivened by the song of the mosquito as well as its irritating accompaniment, and by the buzzing of beetles; while moths and night-loving flies play about the electric lights on board, and render themselves an easy prey to the collector.

During the day numbers of butterflies can be continually seen hovering over the water close to the banks, and a good many cross the water to the other side. They are here, as I have so often observed in other tropical places, much swifter and more erratic in their flight than their cousins at home, so that it was, I found, much more difficult to capture those, of which there were a goodly number, which passed over the ship on their way to the other side, than it would have been had their movements been such as we are familiar with at home.

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[1] An excellent account of this rubber industry, as well as other sources of natural produce, is published in *Diplomatic and Consular Reports*, No. 530, Mr. Vice-Consul Temple's report upon the State of Amazonas.

Other flying insects also visited us as we passed along, perhaps the commonest of which were wasps and hornets of several kinds, the most frequent being a yellow-brown, thin-waisted one, common in all the parts of northern Brazil which I visited, but which seemed to swarm or rather congregate in large numbers, more especially at certain portions of the river. Similar conditions of concentration seemed also to hold good with other insects.

In about six hours the channels began to widen again, and we entered the Huguara *parana*,[1] which is three miles wide, yet not the main stream. Some hours steaming through this, with the same island and forest scenery on either side, brought us quickly into the main river.

Here a glorious stretch of water was spread out on each side, as well

Baraca on Rio Negro.

as behind and before us. Eight to ten miles at least in width could be seen, and yet the distant line of land was not the real bank, but only the islands with which the river is everywhere sprinkled.

It is a curious and solemn reflection, when one gazes at so mighty a river—with a mass of water, in such volume, flowing ever away down to the sea, not in sluggish, slow, and meandering movement, but steadily, silently, with resistless current, which averages some four miles an hour, and continually pouring millions upon millions of gallons, with hundreds of tons of sediment, into the sea,—to endeavour to realise that all this water has descended from the atmosphere, and

[1] Parana is the name given to a branch out of the main stream of the river.

has been collected, for the most part, by the mountains of the Andes, and high lands at its foot, three thousand miles away. A kind of awe invades the mind; the religious instinct is aroused; and the contemplation of so great and magnificent an evidence of the mighty power which governs such glorious works as these compels one to reverence the Author of it all.

Passing the confluence of the Xingu river we proceeded up the main river, the pilot taking us first to one side and again after a time to the other side, in order to choose those portions of it where the current was not so powerful, and therefore did not impede our progress so much, as well as to avoid the sandbanks and shallower parts. We thus had opportunities for inspecting both sides at fairly close quarters. It is noticeable now, that although the surrounding country remains apparently as flat as ever—though some distance away on the north bank some low hills can be seen—the nature of the forest growth is changing somewhat: here there are fewer palms and the rubber-trees more scarce, with, as a consequence, few huts or *baracas* to be seen upon the banks. After passing Prainha (pronounced Prāeenia), a small settlement upon the north bank, the change became more noticeable; the forest showed natural breaks at rare intervals, and a few cattle could occasionally be seen grazing upon the grass at these open spaces, called *campos* (these are, in my opinion, a marked peculiarity; why should the forest, so potent everywhere else, spare them?), while huts began again to become more frequent; and surrounding them, or in their close vicinity, were small roughly cleared spaces where plantations of cocoa had been planted. These, however, appeared always to be in a deplorably uncared-for and neglected condition, the owners or caretakers seeming to take no thought for the future, for no ground was ever cleared for new bushes to be planted; all we saw appeared to be old trees, nor was there any sign of pruning or the cutting away of old dead branches and twigs from those that were producing, but the man solely contented himself with more or less imperfectly clearing away the undergrowth, probably doing this only because he then could more conveniently get at the fruit and reap the harvest upon the bushes already planted!

The ordinary Brazilian loves laziness, and is so indolent that he will rarely do a stroke more work than he is compelled.

Passing more huts—always of the same class as those of the rubber hunters, though now not raised on platforms, small cocoa plantations, and open spaces, Cocoal Grandé is reached. This is a more important, yet small, settlement, again upon the north bank, comparatively well looked after, and has a thriving appearance. Cocoa plantations of more pretension are growing here; the *campo* behind supports a fair stock of cattle, sheep, and ponies; the houses, some of stone, are also more substantial-looking. Continuing our serpentine progress up the river for some distance, and passing Montalegre, after which the low hills upon the north side disappear and the country continues apparently dead flat, we arrive off a small town upon the south bank at the confluence of the fine Rio Tapajos, called Santarém. This town stands upon somewhat higher ground, some forty feet above high-water, and has about 2000 inhabitants,

which trade upon Brazil nuts, sarsaparilla, copaiba, and other produce, much the same as in Wallace's time. Many of the houses are of brick and stone, and it has a church, but impresses one as having a neglected and decaying appearance.

Still ascending the river, which apparently does not lessen in width, and passing Paritacuba, a small place also on the south bank, in the country behind which are large shallow lakes as well as extensive *campos*, we reach Obidos, another small town of similar importance to Santarém. This spot, where, however, we did not stop, is interesting in the fact that here is said to be the only part of the lower one thousand miles of the river where both true banks can be seen at one time. It

Old Nile River Stern-wheeler, now on Amazon. Manaos in background.

narrows here somewhat, and I was informed that near by the depth is a hundred fathoms; this may be an exaggeration, but the comparative narrowness possibly causes it to become deeper than usual at this portion of its course.

Probably on account of the condition of high river at the period of my visit, at which time no sandbanks or bare shore were visible above the surface of the water, I saw very little evidence of animal life, other than insect, as we passed along.

Compared with what I saw in Africa last year upon the Blue Nile, where the banks and shores as well as the water teemed with life, the Amazon is sadly disappointing. The Blue Nile was, however, low at the time, and this may, to some extent, account for the remarkable differ-

ence ; yet not, I think, altogether. North-east Africa everywhere seemed to me to be peopled with life, especially of the higher forms, far more abundantly than north-eastern South America. The only animals, besides monkeys, birds, and insects, which I saw there were porpoises, of which a solitary one or several were frequently seen appearing and disappearing in the water, and fish ; these, of which some are said to be sharks, are of all sizes, many being of goodly proportions, and it was not at all an uncommon thing to see boys and men standing motionless in their canoes, bow and arrow in hand, and ready to shoot at any fish which they wished to obtain. Much of this sort of fishing, as well as by means of nets and weirs, is done, and many of the fish are excellent eating. A considerable number have scaleless skins, while their fins and bodies sometimes are armoured with sharp spines. On account of the large and small voracious fish, bathing is said to be extremely dangerous.

Though we know that the Amazon is the haunt of alligators, tapirs, and manatees, not one of any of these did I catch sight of, in or out of the water; no roar or voice of the ounce or jaguar, puma, or other predaceous animal, rarely only that of the monkey, was to be heard upon the banks night or day. Not a glimpse of deer, pig, or other wild land animal was to be obtained, and altogether, except for insects and few birds, vegetable life was all there was to be seen ; this, however, continued always in the same prodigality everywhere, for, except upon the very steepest and newly fallen banks, nowhere was any spot to be seen unclothed with vegetation. Even the water, for scores of yards into the stream, is invaded by the water-grass and weeds, while masses, some of large area, like meadow-covered islands, had been washed from their moorings and were floating away down to the sea.

Entangled in many of these were frequently large numbers of fallen trees, which often anchored the whole upon a shallow.

In going up and down the river a sharp look-out has to be kept for snags or sunken trees, of which there are large numbers ; the tendency for trees to sink in this river is increased because many of them about the Amazon are of dense, heavy wood which does not float.

Of the birds seen I may mention ibis, herons, ducks, "partridges" or tinamus, black terns, darters, parrots, macaws, toucans, hawks, and vultures, but most of these were only odd examples, and they were not seen near enough to shoot, or to distinguish the details of their plumage. They seemed shy, and not easily approached.

Soon after leaving Obidos, the Parintins hills appear on the south bank; these are about three hundred feet high, and mark the boundary between the two large provinces of Para and Amazonas, of which last Manaos is the capital, and the limit of our ascent of the river. These hills closely approach the river, are completely enveloped in forest, and form a most prominent landmark.

After a while the small town of Parintins, or Villa Bella da Imperatrix, on the same side, is passed ; this latter name is falling into disuse.

Continuing our way, smaller settlements and huts, the occupants mostly employed in cocoa growing, etc., are passed, and after a while

Tabacal, still on the south bank, being left behind, we arrive off Itacoatiara—the Indian name for the Serpa of the maps—situated upon the north bank, above which, not far away, is the junction of the fine Rio Madeira with the Amazon. Up this river much rubber is gathered. Itacoatiara boasts a church or two, has many substantially built houses, and altogether a prosperous appearance. The population is some two thousand. Serpa is the Portuguese name for this place, but this is falling into disuse also; in fact, the Government is encouraging this, and restoring the old Indian names to the places whose names had been changed.

Going to Market with Goods. Near Manaos.

Passing Itacoatiara, we diverge soon from the main stream, and, in order to avoid the current, steam up some fine, wide *paranas* or side channels between the islands. Here, being somewhat closer to the banks and the channel less wide, insects again visit the ship in greater numbers and greater variety, but the commoner are especially the dragon-flies, which are very numerous, and in the evening, besides the mosquitos, many small grasshoppers and beetles. All this while we had the easterly breeze, which blows almost continually, going with us; thus one rather suffers from the heat, but this is reversed when making the descent of the river; then quite a fresh, cool breeze or wind is caused because of the ship's steaming against it.

Making rapid progress, towards the end of the fourth day after leaving Para, we approach the confluence of the Rio Negro and the Amazon, above which the latter is locally called the Solimões.

At this point there is a magnificent stretch of water; the Amazon bends from the south, and the Rio Negro joins it at the north-west corner of this bend. The most remarkable thing about it is, however, the great difference between the colour of the two waters, and the line of demarcation where the two touch. The Amazon has, as already remarked, a strong current, while that of the Rio Negro is much less; therefore the influence of the stronger current is soon apparent in the fact that the Rio Negro water is quickly lost in that of the Amazon. This is of a muddy brown, ochreous colour, and that of the Rio Negro, as its name would suggest, is of inky blackness, so black is it that in looking down into it the appearance is most extraordinary, while reflections from it when calm have almost the appearance as from a mirror or looking-glass. Upon a still, starlit night this reflection is especially splendid and marked. Yet, taken up in small quantity as in a tumbler, the water is perfectly clear. At the point of meeting of the two waters a fairly straight line separating the two is apparent, which line has many swirls and small whirlpools in it; upon each side, frequently at considerable distances from the line, big patches of brown water will bubble up in the black, and *vice versâ*. On the whole it is a sight well worth seeing. At this spot the banks on the north side are higher, and a soft stratified rock appears—a sandstone.

Leaving the Amazon on our left, we then proceed some five miles up the Rio Negro, and soon arrive at the thriving town of Manaos, the capital of Amazonas, the largest state in area of all the United States of Brazil. The town is the centre of the commercial activity as well as of the intellectual and political life of the State, is the seat of the governor, and has a population of about forty thousand. Practically all the professional men, as well as the wealthier merchants, live there, and some time during each year it is visited by almost all the population of the State.

It is well built, has good streets, which are well paved, is lit by electric light, and has a good tram service, the cars of which are driven by electricity.

Several imposing churches, a domed theatre standing upon an eminence, barracks, and well-laid-out public gardens, with monuments here and there, add interest and beauty, while the trees which are planted along the streets afford a grateful shade.

The people are not quite so heterogeneous as those of Para, for the Negro element is not nearly so much in evidence, while Indians of purer blood are far more frequent.

Many of the better-class merchants are Europeans and Americans, the British being represented by several thriving and well-established firms, while British capital controls much of its industry. The principal export is rubber, as in Para, almost its very existence depending upon it. Brazil nuts, cocoa, copaiva balsam, sarsaparilla, and other valuable vegetable products are exported, as well as some deer skins, heron plumes, and dried fish.

One of the principal drawbacks to the prosperity of the place is the lack of regular telegraphic communication with the rest of the world. For some years a cable has been laid up the bed of the river, but this is continually meeting with accidents, being frequently broken by the snags which are so common in the river. Of late the State has, by great labour, cut a road through the forest and laid a line of telegraph in the usual manner as far as Itacoatiara, and this they hope to carry farther, and possibly in time get a line through to Para, and thus obviate these continual breakages.

All transport and extended travel is performed upon the water—for here are no roads in the country, except in the near vicinity to the town

Baraca, with Landing-platform in front. Amazon River.

—and there is a fair service of river steamboats up and down the river, as well as up the various tributary rivers, where rubber is manufactured and settlements formed.

There are several hotels, similar to those at Para, and the sanitary conditions are in a similar imperfect condition.

Indians of fairly pure blood are in the vicinity, but even here one has to go a considerable distance to see them in their more primitive conditions and uncontaminated by the vice of *cashasse* drinking. Those I saw upon an excursion I made at some little distance up a branch of the Rio Negro to a beautiful waterfall, though entirely alone, wore the dress of the Brazilians, and were certainly no more unsophisticated than the lower class Brazilian of town life and European extraction. They were, however, celebrating a *festa*, it being the feast of St. John. Of

course this act also proclaimed them to be Catholic converts. Religion, however, except in this keeping of feasts, is, as far as I saw, little in evidence.

Upon this excursion, by small steam-launch and rowing-boat, I was extremely interested in having an opportunity of travelling, as has already been described by Wallace, among the tops as well as over the tops of the trees and bushes. The water had risen, as it annually does, about fifty feet, and made this branch stream, not much larger than a brook usually, a wide and deep river. When the trees became too thick and numerous as we got higher up the river we had to take to a boat, and by means of the higher trees and branches propel ourselves onwards

Baraca; Canoe brought out by boy to save it from damage caused by the wash of our steamer.

through them. Under these conditions one can see the great advantages of the light narrow canoe used by the Indians and the way they propel them there. This is done by means of short-handled, wide, round-bladed paddles. One of the Indians sits at one end, while a second is at the other, and the paddle is used close against the side by one on one side and the other on the opposite. But should the canoe contain only one occupant, he has acquired by practice the art of propelling his canoe and keeping it straight and in the right direction, at the same time using his paddle all the while upon one side alone; this is said to be most difficult for a novice. The language spoken here, as everywhere in Brazil, is of course Portuguese.

Space will not allow me to go into further details of what I saw and

heard there. I will therefore content myself in saying that the return journey down the river, because of the help of the current, is performed in little more than half the time it takes to go up, notwithstanding the strong breeze against us: that is, a ship steaming with the same propelling force can go down from Manaos to Para in two or three hours over two days, a distance of over nine hundred miles.

I will just note that in passing north *en route* from Para to New York, when some two hundred and fifty miles from the coast, lat. 7° 33′ N., long. 48° 57′ W., we passed through (for some twelve hours, steaming eleven knots) a patch of almost black water. This was considerably to the northward of the line opposite the mouths of the Amazon. The skipper called this water "Humboldt's Black Water," and said Humboldt could not account for its being there. As there is a current running along this coast towards the north-west, this colouration of the water must be due to the influence of the Amazon, which is deflected somewhat north by the current, and because of its volume extends so great a distance out into the Atlantic Ocean.

REVIEW OF THE ALASKA BOUNDARY QUESTION.

By Alexander Begg, Author of the *History of British Columbia*.

Although the location of the Alaskan international line of demarcation remains unsettled between the Dominion of Canada and the United States of America, the treaty which defines that line of demarcation or boundary was negotiated and concluded by and between Great Britain and Russia, in a convention held at St. Petersburg in 1825—*seventy-five years ago.*

To arrive at an intelligent view of the subject, it is necessary to go back and review the circumstances connected with the convention referred to, as far as September 1821, when the Emperor of Russia issued an edict, or ukase, which contained regulations relative to trade on the north-west coast of America, on the eastern coast of Siberia, and the Aleutian, Kurile, and other islands of the Pacific.

The Russian ukase, as presented to the President of the United States, occupied nearly ten pages of a closely printed pamphlet, and contained sixty-three sections. The first section set out by stating that "the pursuits of commerce, whaling, fishing, and all other industry, on all islands, ports, and gulfs, including the whole north-west coast of America to 45° 50′ north latitude, are included in the edict for the purpose of granting the same exclusively to Russian subjects." The second section "prohibits all foreign vessels not only from landing on the coasts and islands belonging to Russia, but, also, does not permit them to approach those coasts and islands within less than one hundred Italian miles, without the vessels being subject to confiscation, along with the whole cargo." (An Italian mile measures 2025 yards.)

A writer in the *North American Review* (new series, No. 37, printed in Boston, 1822), remarks: "We doubt if pretensions so extravagant and unfounded—so utterly repugnant to the established laws and usages of nations—have been set up by any government claiming rank among civilised nations, since the dark ages of ignorance and superstition. . . ."

President Adams, on receiving the Russian edict, along with a note from the Russian ambassador, M. de Poletica, expressed his surprise at the extraordinary claim set forth, and inquired if M. de Poletica "is authorised to give explanations of the grounds of right, upon principles generally recognised by the laws and usages of nations, which can warrant the claims and regulations contained in the edict?"

M. de Poletica, in reply, declared himself "happy to fulfil this task," and wrote a lengthy letter to the Secretary of State, from which it would appear that the edict chiefly related to, as he said, "the new regulations adopted by the Russian American Company, and sanctioned by His Majesty the Emperor, relative to foreign commerce, in the waters which border upon the establishments of the said Company on the north-west coast of America."

The reply by M. de Poletica, which, according to his proposition of fulfilling the task, was to contain historical facts, is published in full in the *Review*, and is shown to be incorrect and erroneous in many of the important points which the ambassador undertook to establish.

The writer in the *Review*, in his criticism, goes on to say: "A few years afterwards, it (Norfolk Sound) was visited for commercial purposes, and, abounding in valuable furs, soon became the general resort of all those engaged in that trade. It was frequented by the vessels of Great Britain, France, and the United States several years before the Russians had extended their excursions so far eastward, and it is therefore clear that they had no claim on the ground of occupation. If, then, prior to 1799, Russia *possessed no rights* on this part of the coast but such as were common to and enjoyed by other nations, we confess," the reviewer continues, "ourselves unable to perceive why the establishing of a few hunters, and mounting some cannon in the corner of Sitka Bay, should give her the right of restraining an intercourse and interdicting a commerce which had hitherto been as free as air, and prohibiting the approach of vessels of other nations to shores which the navigators of such nations first discovered and explored. The claim of Russia to sovereignty over the Pacific Ocean, north of latitude 51°, on the pretence of its being a 'close sea,' is, if possible, more unwarrantable than territorial usurpations."

"We have the authority of Humboldt," the *Review* continues, "for stating that in 1802 the Russian Government limited their territorial claims to the north of 55°. They are now extended to 51°; and M. de Poletica informs us that this is only a moderate use of an incontestable right—intimating that the just claims of Russia extend still farther south. If these usurpations are submitted to, is it improbable that a further use may be made of 'incontestable rights'? With the ingenuity which that gentleman has displayed, it would not be difficult to extend the Russian claims quite to the borders of California, and establish them

there as satisfactorily as he has done to the 51st degree. The Russians have already made a considerable settlement on Spanish territory at Port Bodega, in latitude 40°, and it is *possible* that, guided by the same spirit of philanthropy, which prompted the dismemberment of Poland, the august Emperor may choose to occupy the fertile, but defenceless province of California, and annex it to his already extensive dominions. . . . Great Britain, we apprehend, may see fit to advance claims that will be found to conflict with those of Russia. . . . In justice to the memory of her celebrated navigators Cook and Vancouver, we must declare," says the reviewer, "that the world is more indebted to their indefatigable labours for a correct knowledge of the coast than to those of all others who have visited it. Her subjects were the first Europeans who engaged in the fur trade, and a free access to the *interdicted shores* is, at the present time, as important to them as to those of any other power."

A reference to Captain George Vancouver's Voyages of Discovery in the years 1790, '91, '92, '93, '94, and '95, shows that during the summer of 1794, two of his boats, in charge of officers Whidbey and Johnstone, had been engaged in surveying the north-western coast of North America from Cape Spencer to Port Conclusion. They had Captain Vancouver's instructions in the event of the two parties meeting, which they did on August 17, 1794, to put the finishing stroke on the examination of those shores, within the limits of Vancouver's Commission, "to take possession of the continent from New Georgia, north-westward to Cape Spencer, as also of all the adjacent islands which had been discovered within those limits, in the name of and for His Britannic Majesty, his heirs and successors." On the parties stopping to dine, Vancouver's instructions were carried into execution; the colours were displayed: the boats' crews drawn up under arms, and possession taken under the discharge of three volleys of musketry, with all the other formalities usual on such occasions, and a double allowance of grog was served round to the respective crews for the purpose of drinking His Majesty's health. The happy meeting of the two parties having taken place on the birthday of His Royal Highness, Frederick, Duke of York, "The sound in which they met," Captain Vancouver says, "I honoured with the name of Prince Frederick's Sound, and the adjacent continent, north-westward from New Cornwall to Cross Sound, with that of New Norfolk." Thus the title by discovery, survey and taking possession of the continent and islands as specified, unquestionably vested the sovereignty in Great Britain.

The British Government having learned of the promulgation of the Russian edict, lost no time in representing to the court at St. Petersburg that his Britannic Majesty could not admit or consent to the regulations contained in the ukase. The Right Honourable George Canning, then Secretary of State for Foreign Affairs, nominated Sir Charles Bagot, British Plenipotentiary at St. Petersburg, and instructed him to proceed to the Russian Court to open a convention to have the ukase abrogated, and the territorial boundaries between Great Britain defined and established, upon the basis of the instructions forwarded to Sir Charles Bagot in 1822. The Russian Plenipotentiaries were M. de Poletica, the Imperial Councillor of State and Count de Nesselrode, Imperial Secretary of State.

Many conferences were held, and propositions and counter propositions made on both sides which lasted over two years. In a despatch from George Canning to Sir Charles Bagot, dated 20th January 1824, a letter from Mr. Pelly, Chairman of the Hudson Bay Company, is referred to. It represents that the most southern establishment of Russia on the north-west coast of America is Sitka, in latitude 57°. Mr. Pelly positively affirms that the Russians had no settlement on the mainland, nor any commerce to the eastward of the coast. In the same despatch Mr. George Canning remarks: "The questions at issue between Great Britain and Russia are short and simple. The Russian ukase contains two objectionable pretensions; first, an extravagant assumption of maritime supremacy; secondly, an unwarranted claim of territorial dominions."

Sir Charles Bagot, on 17th March 1824, sent a despatch to George Canning stating that, "it is with feeling of considerable disappointment that after constant negotiations for more than six weeks, after having gone to the utmost limit of your instructions, and after having taken upon myself even to go beyond them, I should nevertheless have to acquaint you that I have entirely failed in inducing the Russian Government to accede to what I consider to be a fair and reasonable adjustment of our respective pretensions on the north-west coast of America, or the adoption of any line of territorial demarcation which appears to me to be reconcilable, under the spirit of your instructions, with our legitimate interests in that quarter of the world.

"In order that I may put you in complete possession of the whole course of my negotiation upon this subject, and may explain the precise grounds upon which I have felt myself compelled to suspend for the present all further proceedings in this business, it will, I fear, be necessary that I should enter into detail, and that I should load this despatch with several papers which are now become of importance. It was on the 16th of last month that I had my first conference with the Russian plenipotentiaries. . . . I laid before them Count Leiven's note to you of January 31, 1823, proposing that the question of strict right should be provisionally waived on both sides, and that the adjustment of our mutual pretensions should be made upon the sole principle of the respective convenience of both countries. . . . This basis of negotiation was willingly accepted by all parties. . . ."

A proposal was verbally made by Sir Charles Bagot, "to make as the boundary, a line drawn through Chatham Strait to the head of Lynn Canal, thence north-west to the 140th degree of west longitude, and thence along that degree of longitude to the polar seas." This proposal was taken for consideration by the Russian plenipotentiaries, who at the next conference offered a contre project, which was reduced to writing, and marked A. It was, generally speaking, found to be inadmissible. Sir Charles Bagot then submitted a modification of his original proposal, marked B, to be submitted at the next meeting of conference. At the next meeting, paper B was met by objections, and a paper marked C brought in by the Russian plenipotentiaries, which was replied to by a paper from Sir Charles, marked D, which contained his ultimate proposition, and stated that it never had been affirmed by the pleni-

potentiaries of His Imperial Majesty, that Russia possessed any establishments whatever on the mainland south of 60 or 59° north latitude.

Ten days after Sir Charles Bagot had presented paper D, he was invited to another conference, when he was informed that the Imperial Government had, after anxious consideration, taken their final decision: and that they must insist upon the demarcation as described by them in the first paper marked A. Finding this to be the case, Sir Charles stated to them that he had already gone far beyond the utmost limit of his instructions, and that he was sorry to say that he "must now consider the negotiations as necessarily suspended: so far, at least, as the question of territorial demarcation was concerned." "Such has been the course of my last negotiation upon the question, and such the grounds upon which I have thought it my duty to suspend it for the present." On the 12th of July 1824, the Right Honourable George Canning sent another despatch to Sir Charles Bagot stating, "After full consideration of the motives which are alleged by the Russian Government for adhering to their last propositions respecting the line of demarcation to be drawn between the British and Russian occupancy on the north-west coast of America, and of the comparative inconvenience of admitting some relaxation in the terms of your Excellency's last instructions, or of leaving the question between the two Governments unsettled for an indefinite time, His Majesty's Government have resolved to authorise your Excellency to include the south points of Prince of Wales Island within the Russian frontiers, and to take as a line of demarcation a line drawn from the southernmost point of Prince of Wales Island, from south to north, through Portland Channel, till it strikes the mainland in latitude 56: thence following the sinuosities of the coast along the base of the mountains, nearest to the sea to Mount Elias, and thence along the 139th degree of longitude to the Polar Sea." (The degree of longitude was afterwards corrected to the 141st meridian.) The despatch continues: "The advantages conceded to Russia by the line of demarcation traced out in this convention are so obvious, as to render it quite impossible that any objection can reasonably be offered on the part of the Russian Government to any of the stipulations in our favour. There are two points which are left to be settled by your Excellency. First, in fixing the course of the eastern boundary of the strip of land to be occupied by Russia on the coast. . . . This is done by a process that that line shall in no case be carried farther to the east than a specified number of leagues from the sea." The distance specified in the treaty is ten marine leagues from the ocean—and "shall never exceed the distance of ten marine leagues therefrom." (Article IV. of Treaty.)

Sir Charles Bagot was succeeded as British plenipotentiary at St. Petersburgh by Mr. (afterwards Sir) Stratford Canning, who was appointed under instructions dated December 8, 1824, as follows:—

"Sir,—His Majesty having been graciously pleased to name you his plenipotentiary, for concluding and signing with the Russian Government a convention for terminating the discussions which have arisen out of the promulgation of the Russian ukase of 1821, and for settling the respective territorial claims of Great Britain and Russia on the north-west coast of

America, I have received His Majesty's commands to direct you to repair to St. Petersburg for that purpose, and to furnish you with the necessary instructions for terminating this long protracted negotiation. . . . The whole negotiation grows out of the ukase of 1821. . . . So entirely and absolutely true is this proposition, that the settlement of the limits of the respective possessions of Great Britain and Russia on the north-west coast of America was proposed by us only as a mode of facilitating the adjustment of the difference arising from the ukase, by enabling the Court of Russia, under cover of the more comprehensive arrangement, to withdraw, with less appearance of concession, the offensive pretensions of that edict. The right of his subjects to navigate freely in the Pacific cannot be held as a matter of indulgence from any power. Having once been publicly questioned, it must be publicly acknowledged.

"It is comparatively indifferent to us whether we hasten or postpone all question respecting the limits of territorial possession on the continent of America; but the pretensions of the Russian ukase of 1821, to exclusive dominion over the Pacific, could not continue longer unrepelled without compelling us to take some measure of public and effective remonstrance against it." . . . The despatch from the Rt. Hon. G. Canning covering the appointment of Stratford Canning concludes by stating: —"It remains only in recapitulation to remind you of the origin and principles of the whole negotiation. It is *not*, on our part, essentially a negotiation about limits. It is the demand of the repeal of an offensive and unjustifiable arrogation of exclusive jurisdiction over an ocean of unmeasured extent: but a demand qualified and mitigated in its manner in order that its justice may be acknowledged and satisfied without soreness or humiliation on the part of Russia. . . . We negotiate about territory to cover the remonstrance upon principle. But any attempt to take undue advantage of this voluntary facility we must oppose. If the present project is agreeable to Russia, we are ready to conclude and sign the treaty. If the territorial arrangements are not satisfactory, we are ready to postpone them; and to conclude and sign the essential part, that which relates to navigation alone; adding an article stipulating to negotiate about territorial limits hereafter. But we are not prepared to defer any longer the settlement of that essential part of the question; and if Russia will neither sign the whole convention nor that essential part of it, she must not take it amiss that we resort to some mode of recording in the face of the world our protest against the pretensions of the ukase of 1821, and of effectually securing our interests against the possibility of its future operations."

Mr. Stratford Canning, before proceeding to St. Petersburg as plenipotentiary, to succeed Sir C. Bagot, was furnished with a royal diplomatic letter of introduction from His Britannic Majesty, King George IV., which doubtless had a beneficial effect on the success of his mission. The royal letter was as follows:—

"His Majesty King George to the Emperor of Russia. Sir,—My Brother: In pursuance of your Imperial Majesty's invitation to nominate a plenipotentiary to assist on my part in the conference which your Imperial Majesty is desirous of holding at St. Petersburg for considering

a plan of pacification between the Ottoman Porte and the Greek Provinces, I had selected for that special commission the Right Honourable Stratford Canning, a member of the Privy Council, late my Envoy Extraordinary to the United States of America, when circumstances which have no doubt been already stated to your Imperial Majesty by your Imperial Majesty's ambassador at my Court, and which will be more fully explained to your Imperial Majesty by Mr. Stratford Canning himself, obliged me to hesitate in taking a part in those deliberations. Being, however, equally animate with a sincere desire to come to a complete understanding with your Imperial Majesty on the important subjects to which these conferences have related, I have still determined to direct Mr. Stratford Canning to proceed to your Court, for the purpose of explaining to your Imperial Majesty with perfect frankness my sentiments thereupon. He is authorised to conclude certain other negotiations which have been some time pending with your Majesty's Government relating to the navigation of the Pacific, and to the boundaries of our possessions on the north-west coast of America; and the experience I have had of his talents and zeal for my service assure me that he will render himself agreeable to your Imperial Majesty.

"I request that your Imperial Majesty will give credence to all he shall say to you on my part; more especially when he shall reiterate to your Imperial Majesty the assurances of my earnest desire to cement more and more the union and good understanding which have so long and happily subsisted between our two crowns.—With sentiments of invariable friendship, I am, sir, my brother, your Imperial Majesty's good brother, "GEORGE R.

"MANU REGIA.

"Carlton Place, 8th December 1824.

"To my good brother, the Emperor of all the Russias."

Mr. Stratford Canning, on February 17, 1825, forwarded a despatch to Mr. G. Canning containing the treaty which had been concluded and signed on the 16th of February. Very slight changes were made in the convention. "The line of demarcation along the strip of land on the north-west coast of America assigned to Russia," Mr. Stratford Canning states, "is laid down in the convention agreeably to your directions. . . . The instance in which you will perceive that I have most availed myself of the latitude afforded by your instructions to bring the negotiations to a satisfactory and prompt conclusion is the division of the 3rd article of the new projet as it stood when I gave it in, into the 3rd, 4th, and 5th articles of the convention signed by the plenipotentiaries. . . . The second paragraph of the 4th article had already appeared parenthetically in the 3rd article of the projet, and the whole of the 4th article is limited in its signification, and connected with the article immediately preceding it by the first paragraph." Again, Mr. Stratford Canning states to George Canning: "You are aware, sir, that the articles of the convention which I concluded depend for their force entirely on the general acceptation of the terms in which they are expressed."

The 3rd, 4th, and 5th articles of the treaty forwarded by Mr. Stratford Canning are as follows:—

"III. The line of demarcation between the possessions of the high contracting parties upon the coast of the continent and the islands of America to the north-west shall be drawn in the manner following:—

"Commencing from the southernmost point of the island called Prince of Wales Island, which point lies in the parallel of 54 degrees 40 minutes north latitude, and between the 131st and 133rd degree of west longitude (meridian of Greenwich), the said line shall ascend to the north along the channel called Portland Channel, as far as the point of the continent where it strikes the 56th degree of north latitude; from this last mentioned point the line of demarcation shall follow the summit of the mountains situated parallel to the coast as far as the point of intersection of the 141st degree of west longitude (of the same meridian); and finally from the said point of intersection, the said meridian line of the 141st degree, in its prolongation as far as the frozen ocean, shall form the limit between the Russian and British possessions on the continent of America to the north-west."

"IV. With reference to the line of demarcation laid down in the preceding article, it is understood:—

"1st. That the island called Prince of Wales Island shall belong wholly to Russia.

"2nd. That wherever the summit of the mountains which extend in a direction parallel to the coast, from the 56th degree of north latitude to the point of intersection of the 141st degree of west longitude, shall prove to be at the distance of more than ten marine leagues from the ocean, the limit between the British possessions and the line of coast which is to belong to Russia, as above mentioned, shall be formed by a line parallel to the windings of the coast, and which shall never exceed the distance of ten marine leagues therefrom."

"V. It is moreover agreed that no establishment shall be formed by either of the two parties within the limits assigned by the two preceding articles to the possessions of the other; consequently, British subjects shall not form any establishment either upon the coast or upon the border of the continent comprised within the limits of the Russian possessions, as designated in the two preceding articles; and in like manner no establishment shall be formed by Russian subjects beyond the said limits."

"IX. The liberty of commerce shall not apply to the the trade in spirituous liquors, in firearms or other arms, gunpowder, or other warlike stores; the high contracting parties reciprocally engaging not to permit the above-mentioned articles to be sold or delivered in any manner whatever to the natives of the country."

On the receipt of the treaty, duly executed, from Mr. Stratford Canning, the Right Hon. G. Canning, under date April 2, 1825, acknowledged the same as follows:—"Sir,—Your despatches were received on the 21st of March. Having laid them before the King, I have received His Majesty's commands to express His Majesty's particular satisfaction at the conclusion of the treaty respecting the Pacific Ocean and north-west coast of America in a manner so exactly conformable to your instructions, and to direct you to express to the Russian Government

the pleasure which His Majesty derives from the amicable and conciliatory spirit manifested by that Government in the completion of that transaction."

The treaty having been completed and accepted as satisfactory by each of the high contracting parties, the occupancy of the north-west coast of America was thenceforward between the Hudson Bay Company and the Russian Company—the former with headquarters at Fort Vancouver, on the Columbia River (transferred to Victoria, Vancouver Island, in 1843—its original name, "Fort Camosun," was continued until 1846, when it was named VICTORIA); the Russian Company had headquarters at Sitka. The two companies managed their affairs without much friction under the treaty. About the year 1838, for mutual convenience, a lease was granted by the Russian Governor at Sitka to the Hudson Bay Company of all rights and privileges possessed by Russia for an annual rental of two thousand land otter skins. This arrangement was continued between the fur companies until about the time of the purchase of Russian America by the United States in 1867.

As soon as Secretary of State Seward obtained possession of the Russian territory he had the Russian flag at Sitka lowered and the United States "Stars and Stripes" hoisted in its stead. For some time after the purchase of Alaska from Russia, public affairs in British Columbia were in a state of transition from the Colonial Government to that of confederation, so that but little attention was paid to what was going on in the remote and almost unknown regions of Alaska. The Federal Government did not show very much interest in having the international boundary line defined and settled. British Columbia was not in a position to take the initiative, and her leading men had to be content with making representations to the Dominion Government.

In 1885 the late Mr. J. F. Bayard, then United States Secretary of State, revived public interest in the subject by applying to Lord Salisbury, through the United States Ambassador at the London Legation, for concurrence in appointing a commission to define the Alaskan boundary, as had been recommended by President Grant in 1872. Lord Salisbury concurred in the appointment as requested. Colonel D. R. Cameron, R.A., was requested in March 1886 to report on the boundary question. His report was completed September 1886.

The communication to Lord Salisbury from Ambassador Phelps was chiefly an echo of Mr. Bayard's letter requesting concurrence in the appointment of a commission to define the Alaskan boundary. This document now becomes specially important, inasmuch as it embodies Mr. Bayard's views of the line of demarcation from its commencement at the southernmost point of Prince of Wales Island, and as those are the views advocated by the United States as being the boundary line set forth in the treaty, viz. *viâ* Portland Canal to the 56th parallel of north latitude. On the other hand, British subjects in British Columbia, and elsewhere in the Dominion of Canada, base their views on the wording of the treaty, and on the direction stated therein, as outlined by the Right Hon. George Canning in his despatch to Sir Charles Bagot, July 12, 1824, and enlarged in accordance with Mr. Stratford Canning's instruc-

tions of December 8, 1824, in connection with his letter to the Emperor of Russia from his Britannic Majesty George IV., which, undoubtedly, with the addition of the whole of Prince of Wales Island being conceded to Russia, had a pacific influence in rendering the treaty acceptable to the Russian Court.

Mr. Bayard probably expected that his route would pass unchallenged when he remarked his conviction was, "that it was the intention of the negotiators that the boundary-line should directly follow the broad natural channel of Portland Channel, midway between the shores, and extend, if need were, inland in the same direction until the range of hills should be reached at or near the 56th parallel. . . . It is not," he continues, "therefore conceived that this water part of the boundary-line can ever be called in question between the two Governments." It may be remarked here that there was no such channel marked on any of Captain George Vancouver's maps or charts. Portland Canal was so named by him, and is so referred to in his *Voyages*, published in 1798 under the authority of the British Government. Another edition of Vancouver's *Voyages* was published in 1801, in which the change from *Portland Canal* to *Portland Channel* is made, without any remark or authority. The substitution of Portland Canal for Portland Channel has caused the difficulty of reconciling the description in the treaty of the line of demarcation, which, according to Mr. Bayard's interpretation, and also that of Colonel Cameron, was under the necessity of going EAST to reach Portland Canal, instead of north—and more particularly in the Right Hon. G. Canning's despatch—from SOUTH to NORTH to the 56th parallel of north latitude: so therefore, it appears, the description of the line of demarcation from Cape Chacon to the 56th parallel given by Sir Charles Bagot in Statement "D," together with the confirmation of the same by G. Canning in his despatch of 12th July 1824, furnish proof that the framers of the treaty applied the name PORTLAND CHANNEL to Clarence Strait; but as the line of demarcation, according to Sir C. Bagot's description, had to leave Clarence Strait, on reaching Duke of York Island, to meet the requirement of the treaty, must proceed eastward and follow Ernest Sound until the coast of the continent was reached at 56°. The combined Clarence Strait and Ernest Sound form the channel prescribed in the treaty, which was called PORTLAND CHANNEL, in conformity with the treaty, but which would have been impracticable in connection with Mr. Bayard's or Colonel Cameron's line of demarcation.

Article IV. of the treaty modified and annulled several propositions made before the suspension of the negotiations by Sir C. Bagot, which were allowed to drop. Amongst those were the zealous efforts of the Russian plenipotentiaries to obtain Portland Canal as a portion of the eastern boundary-line. The diplomatic action of Mr. Stratford Canning in connection with the aid of the letter of King George IV. foiled the expectations of the Russian plenipotentiaries, and left them no option but sign the treaty as made out in the convention. This was accomplished by the concession of the whole of Prince of Wales Island to Russia. It swept away many difficulties, and left the terms of the treaty

clear and capable of reasonable interpretation. It also pointed out a practicable water boundary from the 56th parallel of latitude where the line of demarcation reached the continent in accordance with the treaty.

To continue the line of demarcation from the point on the continent at 56°, towards the intersection of the 141st meridian near Mount Elias, it would be necessary to retrace westward, through Ernest Sound, the former line from Cape Chacon along the east coast of Prince of Wales Island, and proceed by the extended line northward to the end of the island, ten marine leagues from the ocean, and thence northerly between islands Kuiu and Kupreanof to Prince Frederick Sound, and on reaching the 57th degree of latitude proceed west to Chatham Strait, which could be followed to Icy Strait or to Taylor Bay for convenience of landing on the strip of land provided on the continent, westerly ten marine leagues from the ocean to the intersection of the 141st meridian.

(To be concluded.)

HISTORY OF THE HIGHLANDS.[1]

In no country perhaps does geography fulfil its function as one of the eyes of history more fully than in Scotland, and in no part of Scotland than in the Highlands. We must therefore confess some disappointment that in Dr. Mitchell's valuable summary of Highland History so little use has been made of this means of vision. A few lines on Ptolemy's map, and a few more on what is called the configuration of the Highlands, are the only parts of this work devoted to the geographical aspect of the subject which alone can be legitimately considered in a geographical magazine.

Ptolemy's map and description of the northern part of Britain is a veritable will-of-the-wisp which has led astray a succession of philologists and geographers and the historians who have followed their conjectures.

What is usually called Ptolemy's principal error, that he turned the country north of the Forth and Clyde towards the east instead of the north, thus making the east to look towards the south, and the north towards the east, is capable of rectification, and we are disposed to accept the view of General Roy that Ptolemy really possessed a rough map of the island, but "that the part of it containing North Britain had been accidentally torn off and replaced in a wrong position so as to extend the island towards the east instead of the north"—Roy's *Military Antiquities*, p. 116—rather than the conjecture of Bunbury, "that Ptolemy was actuated in great measure by his erroneous idea of the position of Ireland, to which he correctly understood that peninsula (Galloway) to be directly opposite. On the other side, though it was generally under-

[1] *A Popular History of the Highlands and Gaelic Scotland from the Earliest Times till the close of the "Forty-five."* By Dugald Mitchell, M.D. Paisley: Alexander Gardner, 1900. Pp. xv+707.

stood that Britain was opposite Germany, there could be no definite means of connecting the two and fixing the relative positions in latitude." —*Historical Geography*, ii. 641.

But whatever may be the source of Ptolemy's blunder, which will probably never be discovered, the blunder itself is surely sufficient to show how meagre was the knowledge of Scotland conveyed to the Alexandrian geographer in the middle of the second century by the Roman soldiers or sailors, whose service was transferred from the Northern Seas to the mouths of the Nile. Are the few geographical details he supplies or inserts, if the map as well as the description was his work, of any real authority?

Dr. Mitchell, who practically here follows Mr. Skene, says, "we need not look for strict accuracy, but we may very well view what he (Ptolemy) gives us as approximately correct." It may be true that when the above error has been corrected the map and description give a rough idea of the coast of Scotland and its latitude and longitude which probably answers fairly enough to all that was really known of it by Ptolemy. But apart from the names of a few rivers, as to which plausible conjectures may be made, the names of the tribes Otadeni, Gadeni, Selgovae, Novantae, Dumnonii, Vernicomes, Taexali, Vacomagii, Caledonii, Creones, Carniones, Decantae, Lugi, Mertae, Caerini, and Curnavii are (except Caledonii) nothing but names on Ptolemy's map. We never meet them elsewhere before or since except when copied from Ptolemy's map, yet we go on repeating them till half persuaded of their reality. It is impossible to identify them with any division of races known to have existed in or near the districts on the map where they are located, and they afford the widest room for the Celtic philologer to indulge in his favourite amusement of conjectural etymology. The few towns named—Trimontium, Guidi, Alatra, Castra, and the like—are still mere matter of guess-work, and not a single mountain in the northern land of mountains is even named. Skene's map (*Celtic Scotland*, i. 68), attempting to identify the two Ebudae and three other islands south of Ardnamurchan Point with Mull, Islay, Jura, Scarba, and Lismore, is far from "obvious"—a phrase which should often be read "dubious." The fact is that the crude information of Ptolemy cannot be successfully translated into terms of ancient history or modern geography, and although it has become the habit of historians to fill up a few pages of their work with quotations from Ptolemy, no conclusion of importance for history has yet been derived from him. It is better treated by Mr. Lang, who passes it over with the single sceptical remark that "Ptolemy assigns towns (πόλεις) to natives of the south and east, but no traces exist except of the Roman stations"; or better still by Mr. Hume Brown, who regards it only as an antiquarian relic, and by Mr. Lane Poole, who omits the Ptolemaic geography of North Britain from his historical maps. It was a just scoff of the poet at the mediæval maps of Africa and Asia attached to the Latin Ptolemy that he put elephants in place of towns. But in the map of Scotland there are not even elephants.

Nor is the author more fortunate in the way he deals with the configuration of the Highlands. He contents himself with citing a passage

or two from Professor James Geikie, which no doubt correctly describe the origin of the Scottish mountains: "The old tableland of the Highlands and islands are the denuded and unsubmerged relics of vast geological antiquity"; and again, "one of the oldest elevated regions of Europe, a region which has been again and again submerged either in whole or in part."

But what has land more than once submerged in the glacial era or eras to do with history or historic times? If indeed the geologist could tell us what race and character of man first trod the denuded Highlands, or lived in their coast caves, or built forts on their rocky heights, this would be a contribution of some value to the earliest step of Scottish history. But the origin and mode of formation of the land when uninhabited by man is no part of history. This is not mere gratuitous criticism. It is of real importance for the further progress of historic study that the different departments—Geology, Archæology, Philology, Geography, and History—should keep within their own bounds. These bounds, no doubt, sometimes cross each other, and what geology can really throw light on concerns problems of a later, though still, for the most part, of an early age.

Such problems as:—Why Ireland, even then with congested districts, poured some of its superabundant population for whom no America and no colonies had been discovered into the islands and coast of Scotland?

Why, for a time, but for a time only, these Christian missionaries created in Celtic Christianity a bond of union between the west and east of Scotland in spite of racial differences?

Why the centre of Celtic Christianity was shifted from Iona to Scone and Dunkeld, and from Scone and Dunkeld to Abernethy and St. Andrews?

How it was that the Celtic monarchy was threatened for several centuries by the Scandinavian sea power, and how that threat was baffled?

What fixed the independent Scottish nation within its present boundaries?

What were the effects of the physical geography of Highland Scotland, its mountain and water-barriers, the absence of roads and of easily-worked minerals, the abundance of pasture, wild game, and fish?

These are questions—and there are many others—on which geography is entitled to speak, not the last word, or even in some of them a word of much weight, but is still entitled to be heard; and in such questions no one will welcome its aid more than the historian. We trust that nothing has been said to disparage the work of Dr. Mitchell—which is evidently the result of careful study—in reviewing it, as has been necessarily done here, so purely upon the side of geography and in noticing its omissions in that regard.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings in December.

On the 6th December, in Edinburgh, Mrs. Fanny Bullock Workman read a paper on her Ascents of High Peaks in the Himalaya. The Chair was taken by Dr. George Smith, C.I.E. At this meeting Mr. Ralph Richardson, Hon. Secretary, acting on behalf of the Council, moved the following alterations in Laws Nos. XI. and XXVII., of which due notice had been given at the Annual Business Meeting on the 13th November:—

In Law No. XI. the words, "the Chairmen of the Society's Branches" shall be added after "the Trustees."

Law No. XXVII. shall be altered and shall read as follows:—"The property of the Society shall be vested in not fewer than three Trustees."

The motion, which was seconded by Mr. Blaikie, was carried unanimously.

Mrs. Workman delivered her address on Himalayan travel before the Glasgow Branch on the 4th December, the Chair being taken by Mr. Robert Gourlay; before the Dundee Branch on the 12th, the Rev. Dr. Colin Campbell in the Chair; and before the Aberdeen Branch on the 10th, when Mr. John Clarke presided.

On the 13th December, in Edinburgh, Mr. Alfred Sharpe, C.B., addressed the Society on "Trade and Colonisation in British Central Africa." Mr. Wm. C. Smith occupied the Chair. After the reading of the paper a discussion arose, in which the Rev. Dr. Laws, Dr. Scott, Mr. John W. Moir, and the Rev. E. C. Dawson took part. On the 11th December, Mr. Sharpe addressed a joint meeting of the Glasgow Branch with the Geographical and Ethnological section of the Glasgow Philosophical Society.

Meeting of Council.

At a Meeting of Council held on the 19th December, the following lady and gentlemen were elected members of the Society:—

Miss Louise Dundas.	R. Thom Annan.
John Scott.	Lewis Clapperton, M.A., C.A.
Samuel Mechan.	Roderick Macdonald.
A. M'Lennan.	William Martin.
Rt. Hon. Lord Provost Steel.	James Sclater.
Wm. G. C. Hanna.	James Dick.
William Murison.	James Maclay, M.A., LL.B.

Meetings arranged for January.

On the 9th January Major Gibbons will read a paper in Edinburgh on his "Explorations in Marotseland, including journeys up the whole course of the Zambesi, and by the Great Lakes and the Nile to Egypt."

Major Gibbons will repeat his address before a joint meeting of the Glasgow Branch and the Geographical and Ethnological section of the Glasgow Philosophical Society on the 11th. He will also address the Aberdeen Branch on the 10th.

Colonel Sir Thomas Holdich, K.C.I.E., C.B., will address the Society on Railway Communication with India—At Edinburgh on the 22nd, at Glasgow on the 24th, and at Dundee on the 25th January.

GEOGRAPHICAL NOTES.

AFRICA.

The Late Hon. David Wynford Carnegie, fourth and youngest son of the Earl of Southesk, was born in London on March 23, 1871, and was educated at Charterhouse and at the Royal Indian Engineering College at Cooper's Hill. Having been appointed in 1892 to a position in connection with certain Western Australian mines, he became deeply interested in the exploration of the interior, both from the prospecting and the geographical points of view, and undertook three expeditions, the results of which are related in his able work, entitled *Spinifex and Sand*. He returned to London in 1898, and was appointed, a year ago, Assistant Resident of the Middle Niger, Nigeria, under General Lugard. He died on November 27, from a wound by a poisoned arrow, received in a fight with natives.

Franco-Spanish Boundaries in West Africa.—A joint convention, signed at Paris on June 27, 1900, has determined certain questions of delimitation which have long been in dispute. A Spanish claim, urged for more than half a century, included the rivers Mouni and Benito, and extended almost to the Oubangui; this claim was contested by the French, on the ground that Spain had only occupied a few points and islands on the coast (Corisco and Elobey) and had done nothing to develop the interior. A second claim extended the Spanish protectorate from Rio de Oro, inland as far as Adrar, where French explorers had already established the influence of France. In the first case, the decision of the Convention is that France shall give up a rectangle a little more than a degree of latitude in width and about two degrees of longitude in length, from the coast to the 9th degree of longitude east of Paris; this rectangle includes the courses of the rivers Mouni, Outemboni, and Benito. Spain undertakes to occupy this country effectively and to develop it. On the Saharan coast Spain obtains a wide band of country between Capes Blanc and Bojador, including the Tiris; while, towards the interior, the frontier is determined by 16° 20′ longitude west of Paris, and describes in the south-east angle a curve, in such a way as to leave to France the salt mines of Idjil.—*Annales de Géographie*, November 1900.

Lieutenant Lemaire's Explorations of the Zambesi and the Congo have added greatly to our knowledge of these regions. Leaving the gorges of Nzilo, he passed westward, crossing successively the Louboudi, Koulechi, Lougenda, Loukochi, and Kassai rivers, and reached Lake Dilolo, which proved to be entirely isolated, having no connection either with the Kassai or the Zambesi. Thence he passed northwards, following the divide between the Congo and Zambesi basins, and studying the numerous sources of those rivers. The divide was found to be absolutely definite; there is no part from which water flows both ways. It is a sandy plain, dotted with meagre clumps of trees alternating with bare spaces; on the one side are the marshy and slow sources of the Zambesi; on the other, the swift and

clear tributaries of the Congo. A road of some commercial importance, often used by the ox-carts of the Portuguese of Angola, follows exactly the line of the divide. M. Lemaire's opinion, based on geological grounds, is that the true sources of the Congo are the Louboudi, the Koulechi, and the Lougenda, which rise very near the Lunga and the Kabompo, sources of the Zambesi. He has corrected many topographic errors, and entirely discredits the supposed gold mines of Katanga. Little copper was found, but iron is plentiful. The sources of the Zambesi have been visited recently also by Major Colin Harding, who places them at 11° 33′ S. and 24° 51′ E.—*Annales de Géographie*, November 1900.

South African Trade.—Austrian commercial enterprise is evidently taking a keen interest in the South African markets as a field for her industries—an interest revealed in connection with the Austrian Lloyd steamship service to the principal ports of eastern and southern Africa, which was established in October last. This service starts from the Austrian port of Trieste and the Hungarian port of Fiume, and is subsidised by the Austrian Government, with a prospect of Hungarian assistance at a later date, should it prove successful. Great hopes are based by both the commercial and official world, upon the geographical position of the two ports—and more especially Trieste—as the natural point of departure for European merchandise intended for East and South Africa.

The official organ of the Austrian Commercial Institute, reviewing the possibilities of the new market thus opened up, dwells upon the important fact of the Dual Monarchy being the nearest industrial country to South Africa, and that, therefore, Trieste and Fiume have the best chance, not only of Austro-Hungarian export trade, but of attracting through traffic both in goods and passengers. It remarks, also, that Austrian exports from such industrial centres as Bohemia, Moravia, and Silesia, which are now exported to South Africa *via* Hamburg and London, may now reach their destination by means of the direct Trieste route. It further calls attention to such encouraging examples as Germany and Belgium, the German East African steamship service being twice as large as the English and French: while Belgium has obtained possession of the Congo State, and a considerable share in the profits of the numerous enterprises in which it is engaged.

The imports of Cape Colony for the eleven months ending last November amounted to £17,783,530 against £18,144,665 for the corresponding period last year; while the exports for the same period amounted to £7,274,965 against £22,897,993—the decrease being principally in diamonds and gold. Nearly £6,000,000 in specie has been imported during the last twenty-two months.

German Subsidised Mail Service to African Ports.—A copy of a memorandum dealing with the actual terms of the signed contract for the extension of the German subsidised mail steamers to Africa has been received by the Board of Trade through the Foreign Office. The particulars regarding the routes, speed, etc., as contained in Article 1, are as follows:—

Article (1). The following services will be maintained for fifteen years:—

(*a*) A main line with fortnightly voyages right round Africa, and in alternate directions as below:—

(1) From Hamburg, *via* Bremerhaven, a Dutch or Belgian port, Lisbon, Las Palmas, Cape Town, Port Elizabeth, East London, Durban, Delagoa Bay, Beira, Mozambique, Zanzibar, Dar-es-Salam, Tanga, Aden, Suez, Port Said, Naples, Lisbon (a Dutch or Belgian port), Bremerhaven and back to Hamburg (western voyage).

(2) From Hamburg, *via* Bremerhaven, a Dutch or Belgian port, Lisbon,

Naples, Port Said, Suez, Aden, Tanga, Dar-es-Salam, Zanzibar, Mozambique, Beira, Delagoa Bay, Durban, East London, Port Elizabeth, Cape Town, Las Palmas, Lisbon (a Dutch or Belgian port), Bremerhaven, and back to Hamburg (eastern voyage.)

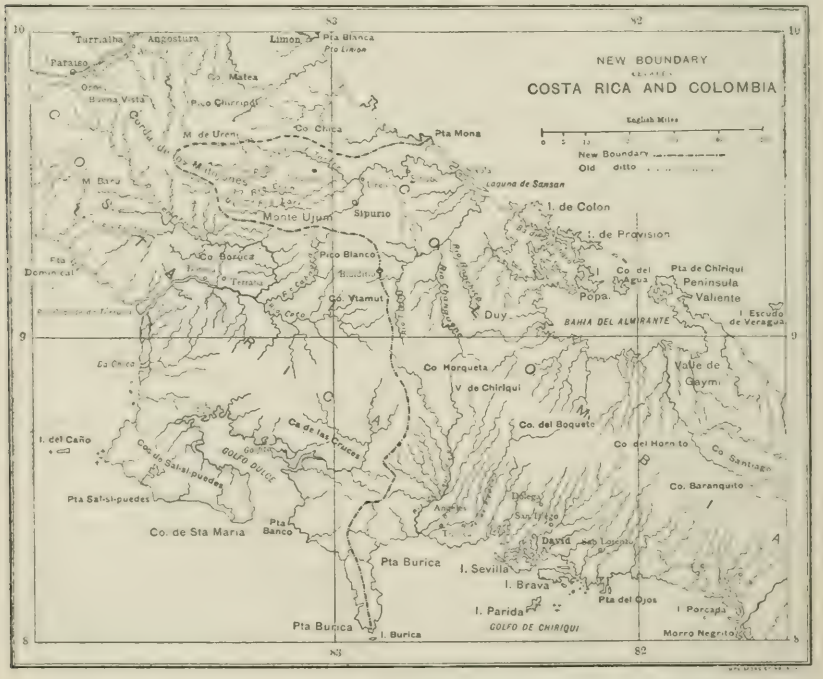
(*b*) A branch line every four weeks from Hamburg, *via* a Dutch or Belgian port, Naples, Port Said, Suez, Aden, Tanga, Dar-es-Salam, Zanzibar, Kilwa, Lindi, Mikindani, Ibo, Mozambique, to Beira, and back by the same ports. This service is to be so arranged that in connection with the steamers of the (*a*) 2 line, there shall be a fortnightly departure from Naples to German East Africa.

The speed to be maintained must average at the least on the (*a*) 1 line from Hamburg to Cape Town, as also from Dar-es-Salam to Naples, 12 knots, and on other parts of the voyage 10½ knots; on the (*a*) 2 line from Naples to Dar-es-Salam, as also from Cape Town to Hamburg, 12 knots, and on other portions of the voyage, 10½ knots; and on the (*b*) line, 10 knots. The gross tonnage of the new steamers, for permanent employment, will be 5000 registered tons for the main line, and 2400 for the branch line.

ASIA.

Burma.—The Gokteik viaduct in the Shan Hills, which is the highest railway bridge in the world, has been successfully completed by the Pennsylvania Steel Company. It was handed over to the Burma Railways Company on December 13th.

AMERICA.



The Boundary between Costa Rica and Colombia, as determined by the arbitration of the President of the French Republic, is shown in the accompanying map.

The text of the decision was published in the *Journal Officiel de la République Française* of September 15, 1900; and the controversy is discussed, from the historical point of view, by Prof. Seler, in *Petermann's Mitteilungen*, 1900, XI.

Trade of Trinidad and Tobago.—The annual report upon the colony for 1899, issued by the Acting Colonial Secretary, is very satisfactory. The estimated revenue, £623,000, was exceeded by £57,000, showing an advance upon 1898 of £66,000, while the expenditure for the year amounted to £748,151—the largest of both for the last five years. £8000 of the revenue increase is due to the fiscal amalgamation of Tobago with Trinidad, which dates from the commencement of 1899, £4000 to the new tonnage dues: but the bulk of the increase is explained by the colony's natural development and general prosperity. The increased expenditure is due to the construction of railway and harbour works, which in 1895 and 1896 was chargeable to a loan, of which, now that the surplus of the colony has been temporarily exhausted, a further issue is about to be made. Had this loan been issued last year, the surplus of the assets over the liabilities of the colony would have been £70,000. The annalised assets in possession of the Crown are of great value. Of 666,000 acres, which are Crown property, only a little more than half is cultivated or developed. If the soil of an agricultural country is its capital, half of the capital of Trinidad still remains idle.

The imports for the year are valued at two and a half million sterling, an increase of over a quarter of a million on those of 1898. The value of the exports was £36,000 in excess of the imports. Trade with the United States is developing remarkably. For the past three years, the average annual value of the colony's trade with Great Britain has been £1,363,000, and with the United States £1,227,000. Trade with British North America is small, although an expansion in this direction is probable in the near future, should the terms on which Canada offers free trade to this colony prove practicable. Such a trade should be promoted by the new steamship service between Canada and certain of the West Indian Islands, including Trinidad and Tobago, the first voyage of which reached Port of Spain last July. The value of the exports of the chief staple products of the Colony for the year were—cocoa, £898,000, sugar, £715,000, and asphalt, £153,000, each of which show a large advance over the preceding year. An item likely to be of importance in the future is rubber. The only kind hitherto exported is the gum of the indigenous balata-tree, and that on a very small scale. Several large estates are now being entirely devoted to rubber-trees, on one of which, at Tobago, 70,000 trees have been planted. Several years must elapse before the produce of these is placed upon the market. The asphalt trade, in 1889, was more prosperous than in any year of its history, 140,000 tons being exported, representing a value of £150,000. The estimated population at the end of 1899 was 290,000, of which 21,000 was attributed to Tobago.

Trade of the Bahamas.—The report in the Bahama Blue Book for the year 1899 has been issued. The revenue for the year amounted to £76,697, an increase of £2330 over that of 1898. The Custom receipts exceeded those of the previous year by £1929, notwithstanding a reduction in the tariff of import duties which came into force on 1st May. The expenditure for the year amounted to £68,748, exceeding that of 1898 by £6295. In the year's expenses, however, several unusual items occurred, over £1700 being spent in the repair of Government House and other public buildings, and £2200 in relieving the destitution caused by the hurricane which passed over the islands in the month of August. The total value of exports for the year amounted to £169,148. The value of

imports amounted to £329,196. The export of sponges was 83,098 lbs. less in weight, and £13,509 less in value than in the preceding year, the hurricane in August seriously affecting the industry, and wrecking the vessels engaged in the work.

The cultivation of the Bahama hemp plant is proceeding satisfactorily under the impulse of a good market. This fibre is exported in steadily increasing quantities, the amount exported in 1899 reaching 1,358,682 lbs. weight, valued at £16,942, being an increase of 106,952 lbs. weight and £2232 value over those of 1898. The land employed throughout the islands in the cultivation of the fibre is now estimated at 14,406 acres, while factories for its cleaning and extraction are established on every small estate. Of eleven working at present, four are in New Providence, two in Inagua, two in Andros, and three in Abaco and Cays. There is room for investment of capital in the fibre trade and also in the fruit trade, in particular, and the future prospects of trade in general were never more prosperous.

The Brazil and French Guiana Boundary Question.—The Swiss Federal Council, after exactly twelve months for deliberation and weighing of evidence in connection with a dispute waged for more than two hundred years by different generations and different forms of government, announced their decision as arbitrators on December 1st last. It fixes the boundary between the two countries as the River Oyapok and the watershed on the Tumuc Humac Mountains. This decision almost entirely embraces the claim of Brazil, while France, by the adoption of the watershed between Guiana and the Amazon basin, obtains only a slight rectification of the line drawn in the Treaty of Utrecht.

The documents laid before the arbitration by France consisted of four large volumes and an atlas of thirty-five maps, while the evidence of Brazil amounted to thirteen volumes of documents and three atlases with about two hundred maps.

The Isthmian Canal.—The Isthmian Canal Commission submitted its report to President M'Kinley on December 4th last. It concludes that the most practicable and feasible route for a canal under the control, management, and ownership of the United States, is the Nicaraguan Route, and estimates the cost of that route at 200,540,000 dollars, a sum much in excess of any estimate formerly given, the increase being due to the larger dimensions and other features not before taken into account. The cost of a canal by the Panama route is estimated at 142,342,579 dollars by one route, and 156,378,258 dollars by another. It also states that in the concession given by Colombia to the Panama Company she agreed not to grant the necessary permission to the United States except upon conditions made by the company. Other possible routes have been carefully investigated, and many field parties are still out, but though the work of the Commission has not yet been completed, it has been considered sufficient for the issuing of its preliminary report.

The depth of the Nicaragua Canal is fixed by the Commission at 35 feet mean low water, with a bottom width of 150 feet, increasing in dimension at certain points. The locks will be 740 feet long, 84 feet wide and 35 feet deep, and the time in which the whole work will be completed is to be ten years. The route—from Greytown to Brito—has a length of 186 miles, while the length of the Isthmus of the Panama route is less than 35 miles, with a summit barely 300 feet above mean tide. But even should the United States obtain the Panama concession of the French Company, it could not hold a perpetual ownership, as that concession provides for the passing of the canal to Colombia at the end of ninety-nine years. In view therefore of all the difficulties which would attend

the obtaining the necessary rights, privileges, and franchises of the Panama route, which, in the opinion of the Commission, would not cost the United States less than that required for the carrying out of the new scheme, the Commission has concluded in favour of the Nicaraguan route.

AUSTRALIA.

The Australian Aborigines.—In response to a memorial, signed by all the British anthropologists and many representatives of other sciences, the Government of South Australia has granted a year's absence to Mr. Gillen, one of the inspectors of aborigines, and the Government of Victoria has provided a substitute for Professor Baldwin Spenser during his absence from Melbourne, in order that these experts may be free to continue their investigations into the habits and folklore of the natives of Central Australia and the Northern Territory. The explorers start in February for the tribes of the MacDonnell Ranges, which will be studied more minutely than before, afterwards proceeding towards the Gulf of Carpentaria, along the Roper river, and, if time permits, down the Daly and Victoria rivers. The task before them is rendered more difficult by the suspicious nature of the natives of the Northern Territory, as compared with the aborigines of the centre, among whom Mr. Gillen is known and trusted. The sum of £1000 has been contributed by the proprietor of the Melbourne *Age* towards the ordinary expenses of the expedition, which has also been allowed by the South Australian Government to make use of the depots and staff of the Trans-Australian Telegraph, for forwarding and storing supplies.

NEW BOOKS.

Travels in England. By Richard Le Gallienne. With six Illustrations by Herbert Railton. London: Grant Richards, 1900. Pp. 291. *Price* 6*s.*

The name of Mr. Le Gallienne is well known to students of George Meredith, of Omar Khayyám, and of Kipling, and is familiar also to general readers on account of the delicate portraiture of his quaintly pretty *Book-Bills of Narcissus*. And though some of his smaller brochures gave occasion to his readers to look at each other "with a wild surmise," his *Prose Fancies* and fine *English Poems* are justly admired. Indeed the beautiful "What of the Darkness?" in the last-named work, is one of our favourite poems. The volume before us represents an excursion, in more senses than one; and we could wish that Mr. Le Gallienne had been content to employ a more correctly descriptive, if less pretentious, title. Having given us, in 1893, the *Religion of a Literary Man*—such as it was—he might suitably have called the present little volume the *Recreation of a Literary Man*, for such, and such only, it is. On inspection, the *Travels* resolve themselves into a bookish itinerary of a brief cycle-tour, undertaken in the summer of 1899, and extending, not from Berwick to Land's End, but only from the author's home at Hindhead near Haslemere, west to Salisbury, and north to the Wrekin. Nor within that compass does Mr. Le Gallienne make any effort to supersede Baedeker's excellent Handbook. Bacon, as every one knows, held that "travel, in the younger sort, is a part of education"; but our cycling Bookman set forth with the avowed object of being out in "green places, and moving through summer-scented air," to enjoy as much sunshine as bountiful heaven might provide. Nevertheless, for purposes of Travel, the little volume is by no

means as idle as "a painted ship upon a painted ocean": its author has the eye of a poet, and a pretty turn for description; and he lovingly discourses on many a familar name and scene. As Gilbert White "was the one and only patron saint" for the journey, we are naturally conducted first to Selborne, in the churchyard of which place "our Gilbert" lies buried; and just as naturally our author's interest is aroused by the sight of a stuffed nightjar fern-owl, or churn-owl in the inn—a bird whose manners White so often studied. At Stratford he sees Sarah Bernhardt make her exit from the theatre, while all the place seemed love-sick; and then betakes himself to the parlour of the *Red Horse* Inn, to meditate on Washington Irving and the *Sketch Book*, with its inimitable account of Stratford. At Hursley the graves of Richard Cromwell, the Amiable, and John Keble, poet and divine, are visited; and a chapter is devoted to a description of Hazlitt's Winterslow. In Salisbury cathedral are preserved some volumes from the library of Izaak Walton ("an excellent angler, and now with God"); and our traveller, who recently edited the *Compleat Angler*, and is more enamoured of the book than of the sport, had the pleasure of handling them. Kelmscott, the home of William Morris, is visited; and likewise the grave—"just a sarcophagus of plain stone, with a touch of simple beauty in its shape, and 'William Morris, 1834-1896.'" Lechlade, where Shelley boated, and Tabley, the home of Lord De Tabley, poet and botanist, are duly pictured. The volume is dedicated to William Sharp, in the following pretty lines:

"Will, you have travelled far and wide
On many a foreign country-side,
Tell me if you have fairer found
Than honeysuckled English ground:
Or did you, all the journey through,
Find such a friend, dear Will—as you?"

J. A. S. B.

The Caroline Islands. Travels in the Sea of the Little Lands. By F. W. Christian. London: Methuen and Co. Pp. 341. *Price* 12*s.* 6*d.* net.

Last year the members of the Society had the pleasure of hearing Mr. Christian lecture on the above subject. He has written this masterly volume on a part of the world the scientific literature of which is rather scant. Admiral Cyprian Bridge in a learned introduction calls for more attention and systematic study being devoted to the South Sea Islands. Mr. Christian has helped very considerably to fill in a gap, especially in the direction of ethnography and philology, on which subjects he is well qualified to speak, having previously spent some six years of travel and exploration in Samoa, Tahiti, and the Marquesas. In these wanderings he made the acquaintance of Mr. Louis Beck and the late Mr. R. L. Stevenson.

The author gives a short chronological sketch of the history of discovery and subsequent occupation of the Carolines, which embrace over 600 islands, extending over a land and sea surface of some 1,800,000 square miles. He then treats of his various journeys to the principal island groups, paying special attention to the character, manner and customs, dress, dwellings, and the folk-lore of the natives, not even omitting the languages and dialects which he gave his careful study, and has compiled a Ponapean dictionary of over four thousand words, a laborious task in itself. The natives, he says, are almost without exception, favourably inclined to the British people, and everywhere he went he was treated with respect and confidence: but we must credit him with gaining and deserving these attributes.

He paid several visits to the ruins of Nan-Matal in the island of Ponape, and these he explored and excavated with as much thoroughness as the hostility, due principally to native superstition and the slack rule of the Spanish, of the king would allow. His descriptions of the beautiful and intensely interesting scenery among the labyrinths of lagoons should please the most artistic taste.

In a lengthy appendix he classifies the philology, native diseases, flora, land and water fauna, etc. Geographers and others are indebted to Mr. Christian for issuing the results of his travels, the cost of which was entirely borne by himself. The volume is well printed, contains many beautiful illustrations and a map, but no index.

From Cape Horn to Panama. A Narrative of Missionary Enterprise among the Neglected Races of South America, by the South American Missionary Society. By Robert Young, F.R.S.G.S. With Maps and Illustrations. London: The South American Missionary Society; and Simpkin, Marshall and Co. Pp. xii + 202.

Two men have made the missions of the South American Missionary Society (Anglican) famous—Captain Allan Francis Gardiner, R.N., their founder, and Charles Darwin, their admiring critic and supporter till his death. Beginning at the volcanic region, Cape Horn, called therefore Tierra del Fuego by the early Spanish navigators, the missions, to the neglected native tribes of South America and also to the European settlers, have dotted the great continent right up to Panama. After visiting the Fuegian Archipelago, Captain Cook and Charles Darwin alike doubted if the savage inhabitants possessed even an articulate language. The missionaries, under the Bishop of the Falkland Isles, have answered that so effectually that Darwin applauded their work as Christian civilisers, and by his support of them offered, as R. H. Hutton wrote in the *Spectator*, "about as emphatic an answer to the detractors of missions as can well be imagined." Our honorary fellow, Mr. Robert Young, F.R.S.G.S., tells the detailed story with sympathetic pen, in this small quarto volume, illustrated with maps and pictures of the natives of the South American Continent. It is done right well from the missionary point of view, and the scientific reader will find new facts of value even to him.

Wild Sports of Burma and Assam. By Colonel Pollock and W. S. Thom. London: Hurst and Blackett, Ltd., 1900. Pp. xx + 507. *Price* 16*s. net.*

This interesting volume is a very important addition to the large library of books that have already been published on wild sports. The authors, Colonel Pollock and Mr. Thom, may be considered the pioneer sportsmen of Lower and Upper Burma respectively. They held high Government appointments, and had ample opportunity for sport and also for making a study of the habits of the wild animals they hunted. Colonel Pollock did most of his shooting from the howdah, being in a position to procure extra elephants when required, besides keeping several of his own. These useful animals are requisite to successful sport in Lower Burma, as their great bulk and strength enables them to crash through the dense jungles which are entirely impenetrable to a man on foot, and they thus beat up the game which the sportsman from his elevated position on the elephant's back has a better chance of shooting.

Mr. Thom did most of his shooting on foot, as the forests of Upper Burma are more hilly and less dense, the vegetation being in many parts annually burnt. This sport seems to have been most exciting and dangerous, as while tracking a wounded bull or tusker he was often charged by the animal, and was

also liable to come suddenly face to face with a tiger or leopard when least expecting it. It must also have been most laborious work in a climate very hot, if not unhealthy, and he must have suffered much from such insect persecutors as gadflies, sandflies, and mosquitoes, which at certain seasons of the year drive the big game—buffaloes, gaur, and even elephants—nearly mad. But all these dangers and discomforts and many other hardships must be made light of by the sportsman who would exploit the big game of any country. The different varieties of game with which this book deals are too numerous to mention in detail here, the principal among them being two varieties of elephants, single-horned and two-horned rhinoceros, gaur (miscalled bison), wild cattle, buffaloes, and wild pigs, also sambur and four or five other kinds of deer. The carnivora are represented by tigers, panthers, leopards, bears, wild dogs, and many kinds of wild cats. The small game consists of pigeons, doves, and pheasants in great variety, also godwit, curlew, crane, pea-fowl, jungle fowl, francolin, plover, and five kinds of quail. Water-fowl are innumerable, such as ducks, geese, and teal, and at certain seasons the snipe-shooting in suitable localities is second to none in the world.

The description of mahseer fishing given in this book will prove most interesting to those who love sport with the rod.

This book, besides describing many individual exploits of the authors, is also a sporting guide to Burma and Assam, giving as it does full directions regarding the sportsman's outfit, battery, servants, etc., and all the practical information required by those who essay a sporting trip to those parts, and will probably be a text-book of Burmese sport for all time.

Arabia, the Cradle of Islam. Studies in the Geography, People, and Politics of the Peninsula, with an Account of Islam and Mission Work. By Rev. S. M. Zwemer, F.R.G.S. Introduction by Rev. James S. Dennis, D.D. Edinburgh and London: Oliphant, Anderson and Ferrier, 1900. Pp. 434. *Price* 7*s.* 6*d.*

Mr. S. M. Zwemer is an American of Dutch descent who has spent ten years in Arabia and the Persian Gulf as one of the missionaries of the Reformed Church in the United States. The example and early death of the Hon. Ion Keith-Falconer, who founded the Aden and Sheikh-Othman Mission of the Free Church of Scotland, led him and Mr. James Cantine, while students under Professor Lansing, to project and carry out a mission to North Arabia at Busrah. Mr. Zwemer has mastered the bibliography of Arabia—of which he gives full and classified lists—in a way no other writer has ever done, having command of Dutch, German, and French, in addition to his familiarity with Arabic, and his long personal experience. The result is this volume, which we do not hesitate to pronounce the best book on Arabia from every point of view—scientific, literary, and missionary. It is well illustrated, especially by such maps as Ptolemy's, Niebuhr's, Palgrave's, and plans of Mecca, Medina, besides maps of Arabia as it now is, and of the islands of Bahrein. The volume cannot, indeed, rank in style with Palgrave's, or with Doughty's *Arabia Deserta*, but it contains and corrects these, while it introduces us to the book of Snouck Hurgronje, the Dutch scholar, who resided in Mecca for a long time. To utilise that book on the pilgrimage to Mecca, Ion Keith-Falconer learned Dutch and lectured on it when Lord Almoner's Professor at Cambridge. Mr. Zwemer's tribute to the value of British rule and administration from Aden all around the Arabian coasts is hearty, and he deprecates the attempts of France and Russia to interfere in the Persian Gulf. We do not know a better short account of Islam, its tenets,

and its evil influence. Mr. Zwemer, whose younger brother and Dr. George Stone "laid down their lives for Arabia," like Ian Keith-Falconer and Bishop Valpy French, writes with the breadth of a scholar, as well as the enthusiasm of a true Christian.

Scotland.—Part I. Edinburgh, Glasgow, and the Highlands. By M. J. B. Baddeley, B.A. With 49 Maps and Plans by Bartholomew. 9th edition. London: Dulau and Co. 1900. Pp. 346. *Price 6s. 6d. net.*

This is a new edition of a part of the well-known "Thorough-Guide" series. It has been enlarged, undergone thorough revision (a special note is made of the extension and revision of the Cairngorms and Kingussie mountains and districts), and contains additional maps and plans. Its completeness should please the most fastidious taste.

Ein Sommer auf Island. Von Dr. B. Kahle, a.o. Professor an der Universität Heidelberg. Berlin: Ad. Bodenburg, 1900. Pp. 285. *Price M. 4.*

This book is more accurate than many travellers' description of Iceland: but it adds no important detail to our knowledge of the country or of the people. Its author has visited several noteworthy localities, and his translated extracts from the Icelandic classics are copious. The map that he reproduces is out of date, and his illustrations are poor, some of them being quite devoid of interest.

Paterson's Guide-Book to the Rhine and its Provinces. With Maps and Plans. Edinburgh and London: Oliphant, Anderson and Ferrier, n.d. Pp. xiii + 174. *Price 1s. 6d.*

The descriptions are detailed in routes, of which there are twenty-five given: these are clearly indicated on a general map. Other maps and plans add to the utility of this handy guide, the price of which is certainly moderate.

L'Exploitation de notre Empire Colonial. Par Louis Vignon. Paris: Librairie Hachette et Cie., 1900. Pp. 355.

The title of this book seems to be a misnomer, for a perusal of its contents discloses an interesting and instructive account of how France has failed to exploit or develop its colonies, and also how the author proposes to remedy the errors which have had such grievous consequences in the past. His statements of facts are based on official documents, and leave little to be desired in the way of plain speaking. Every one from the French nation, the Government, and the Ministers for the Colonies for many years back down to the Colonists themselves, comes in for some censure and rebuke. Indeed, if it had not been admittedly a Frenchman who wrote the book, it might have been suspected that some of the statements were a joke, or the utterances of a malignant, false-speaking enemy, say, a son of "perfide Albion" or a Prussian. For instance, we are told, "la commune du Pont-du-Cheliff (in Algeria) a dépensé en dix ans 50,000 francs pour ses routes sans construire 3 mètres de chemins, se bornant à transformer une partie des électeurs en agents vicinaux *rétribués*." Again we read, "En octobre et novembre 1893 M. Delcassé, favorable au système des compagnies, accorde à M. Verdier, vieux négociant africain, une importante concession à la côte d'Ivoire et à M. Daumas, depuis longtemps établi au Congo, une autre concession dans le bassin de l'Ogowé Deux ans plus tard ses successeurs M. Chautemps et Guieysse, qui professent l'opinion contraire à la sienne, révoquent purement et simplement ses concessions.

En janvier 1894, le préfet de Constantine approuve une convention régulièrement passée entre l'administration et la commune mixte de Morrott et M. Barbontré pour l'exploitation des phosphates de Tabegra ; en octobre 1895 M. Leygues, ministre de l'Intérieur, révoque cette même concession. Les trois concessionnaires évincés se sont pourvus devant le Conseil d'État ; ils ont gagné leur procès et obtenu la condamnation de l'État. Mais est-il possible de rester indifférent devant le mal fait par les ministres qui ont prononcé ces annulations illégales ? Ainsi, des entreprises intéressantes ont été suspendues, des initiatives qu'il eût fallu encourager ont été paralysées, les capitaux, déjà timides, se sont cachés ; enfin, l'on a pu dire que l'État n'était pas 'honnête homme.'" In fact, the disclosures made by M. Vignon show, conclusively and emphatically, how the French colonial empire has been continuously and often nefariously misgoverned, so that it has never had a fair chance of making progress. The remedy proposed by the author, we are glad to observe, is to be found in two measures, one the abolition of the present baleful system of oppressive customs duties, or, in other words, "free trade," and the other in the adoption of the English methods of developing a colony. We on this side of the channel may very sincerely hope that M. Vignon's wise views may take root and speedily bear fruit in France, but we cannot help sharing his misgivings on the subject.

The North-American Indians of To-day. By George Bird Grinnell, Ph.D. London : C. Arthur Pearson, Limited, 1900. *Price* £1, 1*s.*

In this handsome and splendidly illustrated volume Dr. Grinnell endeavours to give an answer to the question of the North-American Indians of to-day—"what are their numbers ? where do they live ? how do they subsist ? are they becoming civilised, educated, learning the white man's ways ?" Undoubtedly, the history of the treatment of its Indian subjects by the Government of the United States is painful reading, and failure seems to have followed nearly every effort to improve, or even to preserve, without diminution of numbers, the Indians of North America. The causes of the failure are very clearly indicated by Dr. Grinnell, and his observations and suggestions as to the choice and qualifications of agents, the period of their tenure of office, the supervision to be exercised over them, the limitations to be put to their authority and the like are very well worthy of the careful consideration of the Indian bureau at Washington. Besides more care in the selection and supervision of their agents, it is absolutely necessary that the Government should compel a better observance of the liquor laws, and insist on good faith and common honesty being enforced in business transactions between the red man and the white. The system of education now on trial should be thoroughly overhauled and remodelled, and all attempts to force on the Indian tribes western methods of cultivation, stock-breeding, and land-tenures should be abandoned in favour of simpler methods, more in consonance with Indian habits and experience. Major Powell has already made some progress in the study of the ethnography of these interesting races, of whom it appears that the linguistic families now number fifty-nine, and represent over eight hundred tribes. Dr. Grinnell's examples of Indian traditions and folklore are very interesting ; but to most readers the great attraction of the book will be the illustrations of typical living Indians by Mr. Rinehart of Omaha, which cannot be too highly praised.

A History of Rhodesia. By Howard Hensman. Edinburgh and London : William Blackwood and Sons, 1900. *Price* 6*s.*

The history of Rhodesia, according to Mr. Hensman, is a short one, as it may be said to begin with the granting of the charter to the British South African

Company in 1889, and previous to then, Rhodesia was only a happy hunting-ground for sportsmen and explorers. But we may still hope that the "lost cities of Mashonaland" will yield up materials from which it may be possible to elucidate and construct the history of former races and civilisations, whose existence for prolonged periods is clearly proved by the extraordinary ruins and remains which are found here and there in the country. Owing to a variety of causes, nothing or practically nothing has been done as yet in the way of scientific exploration or excavation. Any efforts in the latter direction that have been made seem to have had for their primary object the discovery of gold, and the absence of peace and population fully accounts for so little having been done to clear up what is certainly one of the most interesting problems in South Africa. Mr. Hensman is, of course, an enthusiastic admirer of Mr. Cecil Rhodes, and a defender (though in qualified terms) of Dr. Jameson. He gives us a graphic description of the initial difficulties of founding the colony, and shows all the skill and versatility of a war-correspondent in his account of the Matabele war and the suppression of the Matabele rebellion. It seems impossible to write a book on South Africa nowadays without an account of the Jameson raid, so we have a chapter on it, and Mr. Hensman adds to the history of Rhodesia sketches of the sieges of Kimberley and Mafeking. In brief, the book seems to have been hastily compiled to catch the present "khaki" humour of the public. The style is easy and attractive, and likely to be approved by many readers.

Traité de Géologie. Par A. DE LAPPARENT. 1ᵐᵉ Édit. Paris: Masson et Cie., 1900. Pp. 1912 (in three divisions).

Professor de Lapparent has taken the opportunity afforded by the appearance of this new edition partly to recast his work and to add considerably to its bulk. When the *Traité* made its first appearance, eighteen years ago, the only important text-books of geology within the reach of French students were translations of English and German works. De Lapparent's book was warmly welcomed, and in each subsequent edition the author has so improved his work that not only has it maintained its place in France as the standard text-book, but it has become increasingly valuable as a work of reference to the geologists of other countries. On comparing the present with the preceding edition, we find that the author has done all he could to present his readers with the very latest data, and to put before them the general results of the various important investigations and discussions which have of late years interested geologists. In particular, we note that he has entirely recast his description of the geological systems, and has so arranged his matter that this portion of the work acquires enhanced importance to geographers, who are interested in the question of the evolution of lands and seas. To illustrate the palæogeography referred to, a large number of charts of Europe and of France, showing the distribution of the ancient seas, have been inserted in the text. The author does not pretend that these sketch charts are more than rough draughts or approximations. But he hopes, and we think rightly, that they will lighten the task of students, and the observations and criticisms of competent geologists will doubtless enable him to improve them for a future edition. Of late years the writers of geological text-books have more or less diffidently touched upon the subject of geographical evolution. There is so much in the geological evidence that is still obscure and uncertain that they have hesitated to attempt graphic representations, lest the student should suppose that the restorations were more than they pretended to be. There can be no doubt, however, that one of the chief aims of geological science is to trace the development of our lands and

seas, and that geological text-books would be less repellent and dreary had their authors the boldness of Professor de Lapparent, who has now attempted to reconstruct the successive episodes in the geographical evolution of our globe. It is interesting to remember that the earliest attempts of the kind were made by a famous French geologist, Elie de Beaumont, who thus illustrated his lectures so far back as 1836. Our knowledge of the earth's crust has enormously increased since then, as any one will realise who shall compare the restorations of palæogeography by Beudant (*Cours élémentaire de Géologie*, 1841) and by Vogt (*Lehrbuch der Geologie und Petrefactenkunde*, 1845) with the much more detailed reconstructions given in the present edition of Lapparent's *Traité*.

Le Transvaal et l'Angleterre en Afrique du Sud. Par GEORGES AUBERT. Paris: Ernest Flammarion. Pp. viii. + 346.

This book is for the most part a reproduction of a work which the author published some two years ago with the imprimatur and blessing of the now notorious Dr. Leyds, who wrote: "Votre livre ne manquera pas, j'en suis persuadé, d'encourager vivement l'émigration française dans notre pays et d'y fortifier ainsi l'élément français si nécessaire à notre développement économique et intellectuel." The present edition was written apparently about the end of 1899, and the author's political sagacity and foresight may be gauged by the fact that he repeatedly discusses the future of South Africa in general, and of the Transvaal in particular when the Boers have completely triumphed over the British, and in one passage he even hints at England having to pay an indemnity. On the other hand, in various passages he does admit the possibility that the Boers may get the worst of the struggle. His chapters on the previous history of South Africa and the events which led up to the present war are amusing, as they give us a fair idea of what the average French writer thinks of late events, and how far wrong he can go in his appreciation of contemporary history. The rest of the book is a sketchy account of Cape Colony, Natal, the Orange River Colony, Transvaal, etc., of no use to an English reader, who has at his hand a hundred other works much more interesting and much more trustworthy. The book has a map, indifferently accurate, as showing the *status quo* of two years ago, and, of course, quite useless now, and there are also some very poor illustrations.

The Ruined Cities of Ceylon. By HENRY W. CAVE, M.A., F.R.S.E. London: Sampson Low, Marston, and Co., Limited, 1900. Pp. 165. *Price* 12*s*.

To those who cannot afford to purchase the original edition of Mr. H. W. Cave's *Ruined Cities of Ceylon*, the publication of this second and cheaper edition will be very welcome. It contains the whole of the illustrations of the first edition, and three additional illustrations, from which the reader can carry away a fairly good idea of the condition and appearance of the ruins when Mr. Cave visited them in 1896. His descriptions are lucid and comprehensive, and he eschews the over-use of technical terms. It is evident that only a beginning has been made in the excavation of these wonderful buildings, but what has already been achieved is sufficient to encourage the Cingalese Government, which has not been badly hampered like that of the adjoining continent with plague, famine, and war, to carry on a work from which most interesting results may be confidently anticipated. Some two thousand years ago Ceylon was the headquarters of Buddhism and a flourishing commercial emporium. These ruins attest its greatness, and their exploitation is a matter of profound interest to the archæologist, antiquarian, and student of history.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

QUEEN VICTORIA, DIED 22ND JANUARY 1901.

A FORMER ICE AGE IN SOUTH AFRICA.

MANY years ago Sir Andrew Ramsay startled geologists by his remarkable paper on the glacial origin of the Permian breccias of England. The evidence, he maintained, clearly showed that glaciers and floating ice had existed in England in late Palæozoic times. While many geologists agreed with his conclusions, others remained sceptical, and tried to explain away the evidence by various ingenious suggestions. But since the appearance of Ramsay's paper many data have been gathered in widely separated regions, which leave little or no room for doubt that a glacial period of extreme severity characterised the close of Palæozoic times. Alike in South Africa, in Central India, and in Australia, geologists have come to the same conclusion as Ramsay. The glacial origin of the Indian and Australian erratic accumulations is now generally conceded, but geologists have been somewhat sceptical as to the former occurrence of an Ice Age in Southern Africa—although it must be admitted that the evidence set forth by Dr. Sutherland, upwards of thirty years ago, seemed hardly explicable in any other way than that maintained by him. But just as in Ramsay's case so in that of Dr. Sutherland, much doubt has been expressed as to whether his interpretation could be accepted. But during the past thirty years geologists in South Africa have not been idle, and the result of their investigations goes to show that about the close of Palæozoic times an Ice Age of great severity did really supervene. In the *Report of the Geological Survey of Cape Colony for 1899*, we have much additional evidence described by Messrs. Rogers and Schwarz, and Professor Corstorphine presents an admirable *résumé* and review, which is so interesting that we cite it nearly in full. After brief reference to the Appendices, in which are contained the detailed evidence collected by the geologists, Dr. Corstorphine writes as follows:—

"A trip along the extreme north of the Colony seemed, from what had been previously written, to give prospect of extended and possibly new information about the 'DWYKA CONGLOMERATE,' and at the same time to afford opportunity for the investigation of the older rocks, mainly granite and different types of schists, which may, or may not, be the equivalent of the rocks on the south, for which we have adopted the name Malmesbury Beds. It was also an instruction that coal 'indications' should receive special attention, but, unfortunately, neither Mr. Rogers nor Mr. Schwarz saw anything which the most sanguine imagination could construe into an 'indication.' The present value of the survey therefore lies in the gain to our knowledge of the northern conglomerate, which since 1886 has,[1] with that on the south, been termed 'Dwyka Conglomerate.'

"In the subsequent details of the Prieska survey the name Dwyka Conglomerate has not been retained, but we have for the present reverted to the older one, GLACIAL CONGLOMERATE, originally used by E. J. Dunn. This name has been adopted, not to indicate that the northern rock is something absolutely distinct and different from the southern 'Dwyka Conglomerate,' but chiefly to emphasise the main fact, and because there is, in addition, as will be seen in the sequel, an important distinction between the two, and it seems likely that later, in spite of such inconvenience as may thereby be caused, some more distinctive name than Dwyka Conglomerate must be adopted, at least for the northern outcrop. At present, however, we have no intention of seriously disturbing the accepted nomenclature, and our reluctance to apply the name Dwyka Conglomerate to the rock here considered may appear uncalled for, but the character of the rock is so different from that of the outcrops on the Dwyka river, that the adoption of another name appears desirable. It seemed better, therefore, to revert for the present to the most descriptive of the older names which may assist, and will be amply justified if it tend to, the presentation of a clear statement of the facts of the case. The following discussion of the northern conglomerate involves the southern one as well, since, in spite of the differences referred to, there can be no doubt that the two are closely related.

"The Prieska conglomerate surveyed last year was known to Wyley,[2] who named it TRAP CONGLOMERATE, but did not otherwise suggest that

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"[1] E. J. Dunn: *Report on a supposed extensive Deposit of Coal underlying the Central Districts of the Colony.* Cape Town, 1886.

"[2] Andrew Wyley: *Notes of a Journey in Two Directions across the Colony.* Cape Town. 1859.

"In this report Wyley describes the southern exposure of (Dwyka) conglomerate at Pienaar's Kloof, near Touws River, under the name Trap Conglomerate. He states also that he recognised the same rock at Graham's Town and the Ecca Valley, and enters into his view of the nature of the rock, and his reason for rejecting "Claystone-porphyry," the term used for the conglomerate by A. G. Bain. Further on (p. 29) he first mentions the northern conglomerate, as a "peculiar trap conglomerate," occurring apparently interstratified with the schists. Five or six miles below Hope Town, he again saw "a peculiar trap (?) conglomerate forming thick horizontal beds" (p. 34). In neither of these two references does he suggest, otherwise than by the mere use of the name, which in the second instance he queried, that this northern rock is the same as that at Pienaar's Kloof.

it resembled or belonged to the conglomerate outcrops on the south to which he applied that name. A. G. Bain has not, so far as I know, left any account of geological work done by him in the Prieska area, but, as is well known, in both of his important papers [1] he named the southern conglomerate with which he was familiar near Graham's Town and also in the southern Karroo, 'Claystone-porphyry' (the modern felsite or quartz-porphyry), and described it as an intrusive rock. Wyley's view of the origin of the same outcrops did not essentially differ from this, and a further supporter of the igneous origin was found in the late Dr. W. G. Atherstone, of Grahamstown.

"In Natal the outcrop of the peculiar conglomerate attracted the attention of Dr. P. C. Sutherland, who in a letter to Sir R. I. Murchison, in 1854, obviously refers to the conglomerate when he mentions a 'species of trachyte,' underneath which there appear grooves and scratches, which were then ascribed by the author to the movement of the molten volcanic rock.[2]

"But Dr. Sutherland's valuable contribution to the subject came fourteen years later, when he referred the phenomena for the first time to glacial action. This view of the origin of the conglomerate was given by Dr. Sutherland in a lecture to the Natural History Association of Natal, and subsequently published.[3] Basing his statement on observations which he had made at Maritzburg and elsewhere, Sutherland decided that the rock is a BOULDER-CLAY of Permian age.[4] This conclusion is the more remarkable, when one considers that the conglomerate at Maritzburg has the same petrographical character as that of the Southern Karroo, for which a glacial origin has been again and again dismissed, while further, in turning from volcanic to ice action, Dr. Sutherland broke entirely new ground.

"Shortly afterwards (1870) Mr. C. L. Griesbach [5] described the Natal outcrop as a 'Boulder Bed'—a perfectly suitable if non-committal name, —and ascribed the peculiar appearance of the boulders to weathering.

"About the same time, or perhaps earlier, G. W. Stow,[6] working in Griqualand West, observed evidences of glacial action in a conglomerate, which is doubtless the northern continuation of that at Prieska. Stow, however, seems to have made his observations the basis for a belief in

[1] *Trans. Geol. Soc.*, Lond., 2nd ser., vol. vii. pp. 53-59. *Ibid.* pp. 175-192.

[2] P. C. Sutherland: 'Notes on the Geology of Natal, South Africa' (in letters dated March 13, 1854, and November 3, 1854, to Sir R. I. Murchison).—*Q.J.G.S.*, xi., 1855, pp. 465-468.

[3] 'On the Geology of Natal,' a lecture to the Natural History Association of Natal, June 27, 1868. Printed at the *Natal Mercury* Office. Durban, 1868. An abstract of the portion on the conglomerate was communicated by A. C. Ramsay to the Geol. Soc., London, under the title, 'Notes on an Ancient Boulder-Clay of Natal.'—*Q.J.G.S.*, xxvi., 1870, pp. 514-516.

[4] Mr. Dunn's remark on page 7 of the *Report on a Supposed*, etc., 1886, does not quite do justice to Dr. Sutherland's clear conclusion.

[5] 'On the Geology of Natal, in South Africa.'—*Q.J.G.S.*, vol. xxvii., 1871, p. 58.

[6] A portion of Stow's work was published as 'Geological Notes upon Griqualand West.'—*Q.J.G.S.*, vol. xxx., 1874, pp. 581-680. By far the greater part of his work has remained in MS., and is, I understand, in the possession of the Geological Society of South Africa, Johannesburg.

a South African Pleistocene Ice Age. One scarcely wonders at this mistake, but can rather find its excuse in the marvellously fresh appearance of the *roches moutonnées* and striated pavements of the north of the Cape Colony.

"In 1872[1] Mr. E. J. Dunn first became acquainted with the northern rock. He represented it on his earliest map as 'GLACIAL CONGLOMERATE' at the very top of the list of sedimentary formations, but gave the southern outcrops of conglomerate under Wyley's name 'Trap Conglomerate,' obviously also in Wyley's sense of an intrusive breccia.[2] On the second edition[3] of Mr. Dunn's map the name 'DWYKA CONGLOMERATE' appears in the legend as indicating an igneous rock, and designating all the outcrop on the south and west of the Karroo, which on the former map was styled 'Trap Conglomerate,' while the northern conglomerate is still represented as 'Glacial Conglomerate,' and again obviously as the newest sedimentary formation. On this map the Natal outcrops are also represented in the same sense as those on the south of the Karroo. With neither of these maps was there any text published.

"In a report issued four years later,[4] however, Mr. Dunn explains his grouping of the ECCA BEDS as 'embracing the conglomerate called a porphyry by Mr. Bain and a trap conglomerate by Mr. Wyley.' A little further on in that report (p. 6) Mr. Dunn uses the name 'DWYKA CONGLOMERATE,' and on the following page he speaks of 'the much misunderstood Dwyka Conglomerate, so called because of its thoroughly characteristic occurrence near the river of that name.'

"In the subsequent paragraphs he discusses the nature of the rock and the inappropriateness of the names previously given to it: he notes 'the admixture of large and small rounded and angular pieces of rock,' and that 'the great variety of rocks present, many of them unknown *in situ* for an immense distance from the outcrops of conglomerate, is not to be lost sight of'; he further quotes Sutherland as 'leaning to the theory' that the conglomerate was laid down by glacial agency, and agrees with him as to the resemblance of the decomposed rock near Durban to the boulder clay of South Wales and elsewhere, but states that no striations had till then been found on any of the boulders, though they might exist. (*Loc. cit.* p. 7.)

"The appearance of the name Dwyka Conglomerate on the 1875 map appears then to be the introduction of this term for the southern rock, though at that time Mr. Dunn still held the old idea of the igneous nature of the conglomerate, and it was not till the publication of the 1879 report that he accompanied the change of name by a very impor-

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"[1] E. J. Dunn: *On a Gold-prospecting Expedition, 1872.* Cape Town, 1873, pp. 12-13.

"[2] Geological Sketch Map of Cape Colony, compiled by E. J. Dunn. London: Stanford (1873).

"See also 'On the Mode of Occurrence of Diamonds in South Africa,' by E. J. Dunn, *Q.J.G.S.*, vol. xxx., 1874, where, p. 56, the Trap Conglomerate is mentioned as 'the most recent and most interesting eruptive rock in South Africa.'

"[3] Geological Sketch Map of South Africa, compiled by E. J. Dunn. London: Stanford (1875). This edition presents a much larger area than the first one.

"[4] *Report on Cumdeboo and Nieuweveldt Coal.* Cape Town, 1879. p. 4.

tant change of view as to the nature of the rock, and expressed the opinion 'that the so-called trap conglomerate is as much a sedimentary rock as the sandstones above and below' (*loc. cit.* p. 8). From the additional statement further on (p. 10), that nothing definite was known of the formation of the Dwyka Conglomerate, Mr. Dunn was even then obviously far from satisfied with his own knowledge, and still desirous of obtaining something more conclusive.

"In one of his later reports[1] Mr. Dunn reverts to what from our present knowledge seems to be the preferable, as well as older, name for the southern outcrop—'Ecca Conglomerate.'

"He reached a further stage in the well-known *Report*[2] *on a supposed extensive Deposit of Coal underlying the Central Districts of the Colony*, with which he published a rough sketch map showing, for the first time, the northern 'Glacial,' and the southern 'Trap' or 'Dwyka' conglomerate, as being of the same age, and having a continuous outcrop on the north, west, and south. The name here adopted by Mr. Dunn was 'Dwyka Conglomerate (Glacial),' and the connected outcrop is shown as being beneath the Lower Karroo Beds. The third edition of the complete map, published separately in 1887,[3] shows practically the same outcrop, and again under the single name, in the same stratigraphical position, though now included as a portion of the Lower Karroo or Ecca Beds.

"On both of these maps, then, the united conglomerate is placed by Mr. Dunn above the Witteberg Quartzites, and below, or at the base of, the Lower Karroo (Ecca) Beds, and no distinction is drawn between the nature of the northern rock, or its relation to the underlying series, and the features presented by the southern outcrop.

"The 1886 report by Mr. Dunn, just referred to, supplements the description of the northern glacial phenomena given in the report of 1873,[4] and has the following account of the outcrop of the conglomerate along the north, west, and south of the Colony:—

'The present outcrop from the Vaal River, near Kimberley, along the Vaal and Orange Rivers, passing Hope Town, then westwards towards Prieska, where the Doornberg appears to have diverted the course of the ice away from the present course of the Orange River; thence along the south-west of Doornberg and Ezelberg and through Bushmanland as a broad belt, twenty to forty miles across, known as the Kijenveld: from Leeuwenfontein Pan, in Bushmanland, the belt of conglomerate bends southward, passing about twenty miles to the west of Calvinia. From this it becomes altered and involved in the plications of the enclosing strata. It continues on past Patats River, near Karroo Poort; thence it runs nearly due east, as several irregular belts, past Buffels River on the Western Railway, past Prince Albert, Willowmore, Mount Stewart, on the Graaff-Reinet Railway, north of Alicedale Junction, on the Graham's Town Railway, north of Botha's Hill, and out to the sea at Goulana River mouth. It reappears at St.

"[1] *Report upon Recent Coal Borings in the Camdeboo and Stormberg.* Cape Town, 1883, p. 12.

"[2] Cape Town, 1886.

"[3] Geological Sketch Map of South Africa, by E. J. Dunn. Melbourne: Sands and M'Dougall, 1887.

"[4] *On a Gold-prospecting Expedition, 1872.* Cape Town, 1873.

John's River, crosses the Umzimkulu River near the Drift, passes to the east of Richmond, in Natal, it continues past Pietermaritzburg, past Grey Town, and on to the junction of the Buffalo and Tugela Rivers.'

"The above statement, together with the representation of the outcrop on the map published with the report, and on the separate one of 1887, is the basis on which the identity as well as the continuity of the two conglomerates at present rests.

"In the report just quoted Mr. Dunn gives such a definite account of the striated rocks underneath the conglomerate, at the junction of the Orange and Vaal Rivers, that it appears strange its glacial character, at any rate in the north, should ever have been subsequently doubted.

"Nevertheless, since 1886, numerous papers dealing with the conglomerate have appeared, and among them there are many which cast doubt, not merely on the continuity of outcrop, or identity, of the northern and southern conglomerates, but also on the glacial character of one or both.

"Professor E. Cohen, now of Greifswald, visited South Africa in 1873, but it was not till 1887 that he published his observations on the Dwyka Conglomerate, which he examined between Karroo Poort and the Patats River, and also at Pietermaritzburg. Cohen gives the results of his observation of the rock, in the field and under the microscope. He concludes that at Karroo Poort and in Natal the occurrences are the same, and that the rock is throughout of purely clastic material, and *not* a product of volcanic activity, whether a lava or an ash eruption. In the Hope Town conglomerate Professor Cohen did not detect distinct proofs of glacial origin.[1]

"The late Professor A. H. Green, who visited South Africa in 1882, examined portions of the southern outcrop, and introduced another view of the origin of the conglomerate. His notion, expressed in a paper to the Geological Society,[2] London, in 1888, was that it is a coarse shingle formed along a retreating coast-line; but he mentions the size and angularity of the boulders as suggesting ice-action, while one pebble which he found at Prince Albert might, he says, pass for an ice-scratched block in a country known to have been glaciated.

"From the hand specimens, Sir A. Geikie and Dr. F. H. Hatch[3] suggested to Professor Green that the rock had 'the aspect of a volcanic breccia.' As the specimens which Green took home with him were presumably from the two localities—Willowmore and Prince Albert—where he himself visited the conglomerate, that suggestion was one which their appearance would fairly well justify. Green's own marked hesitation as to the glacial character of the rock was also doubtless due to the unfavourable field evidence of both of the above localities, though,

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[1] 'Geognostisch-petrographische Skizzen aus Sud-Afrika.'—*II. Die Karrooformation*, etc.

Neues Jahrbuch f. Min., etc. Beil-Bd. v., 1887. pp. 196-274.

[2] 'A Contribution to the Geology and Physical Geography of the Cape Colony.'—*Q.J.G.S.*, vol. xliv., 1898, pp. 239-270.

[3] *Loc. cit.* p. 243. See also F. H. Hatch, 'A Geological Survey of the Witwatersrand, etc.'—*Q.J.G.S.*, vol. liv., London, 1898, p. 94.

even at Prince Albert, one may easily collect among the weathered boulders, many stones showing undoubted glacial striæ.

"Later in the same year Dr. A. Schenck [1] supported the theory of the glacial origin of the 'Dwyka,' but held that its identity with the northern glacial conglomerate must still remain doubtful.

"In the following year Dr. F. M. Stapff [2] submitted that there was little evidence of the connection of the northern and southern outcrops, and none at all of glacial action in the 'Dwyka.' In so far as he admits glacial phenomena in the northern rock, Dr. Stapff seems, if I follow his argument correctly, to explain these on the assumption that floating ice from the Antarctic Continent brought the scratched stones northwards during Pleistocene times, while this part of the world was, according to his view, more submerged than at present.

"A second paper, in 1889, by Dr. Schenck [3] gives a very clear discussion of the two main questions raised in Stapff's paper. Here Schenck is of opinion that the evidence points rather to the conglomerates being identical, and he has no hesitation in assigning a glacial origin to the 'Dwyka,' as well as to the northern rock, which he names 'Vaal Conglomerate.' Stapff, in a reply [4] to Schenck's paper, maintains his original position.

"In a report [5] on the Prince Albert District, published in 1893, Mr. A. R. Sawyer describes the Dwyka Conglomerate as 'a sedimentary rock,' and says:—

"A careful examination of this rock as it appears in the field, and of the matrix sliced for examination under the microscope, shows it to be undoubtedly a volcanic ash, mixed no doubt in part with other fragmentary materials derived by the operation of moving water.

"The numerous volcanic pipes in the Karroo, open to the present surface level, are an indication of the source from which the volcanic ashes were ejected.

"After this report no additional observations were recorded as to the Dwyka Conglomerate of the Cape Colony till 1896, when in the course of the geological survey, Mr. Schwarz discovered undoubted ice-scratched, facetted boulders in the Ceres district, imbedded in the typical hard, dark-coloured rock of the southern Karroo.[6]

"Since that discovery, one might think that the number of striated boulders in the conglomerate had enormously increased, for there are

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"1 'Die geologische Entwickelung Südafrikas.'—*Pet. Geogr. Mitt.*, Bd. xxxiv., Gotha, 1888, ss. 225-232.

"2 'Das "glaziale" Dwykakonglomerat Südafrikas.'—*Naturwiss. Wochenschrift*. Berlin, 1889.

"3 'Ueber Glacialerscheinungen in Südafrika.'—*Verh. des VIII. deutschen Geographentages in Berlin*. Berlin, 1889, pp. 145-161.

"4 *Ibid.* s. xvii.

"5 *Report upon the Geology and Mineral Resources of the Division of Prince Albert and Surrounding Districts.* Cape Town, 1893, p. 4.

"6 *First Annual Report of the Geological Commission.* Cape Town, 1897. p. 28 (8vo. p. 36).

few places where the typical 'Dwyka' is well exposed which have not, without any very prolonged searching, yielded good examples of ice-scratched stones. It is true that many are found with such slight traces of striation, that one would never place any weight on their evidence if unsupported, but the existence of numerous stones with unmistakable striæ throws full light on the character of the doubtful ones.

"From Prince Albert to Matjesfontein, and also at Worcester, the most southerly outcrop in the Western Province, striated boulders occur abundantly in the conglomerate; but, as was stated in the report for 1897 (p. 41), these boulders yield the only evidence of glacial agency having played a part in the formation of the rock on the south, as there it always presents a distinct conformity with the beds beneath and above.

"While the foregoing gives the history of the chief past investigations as to the nature of this much discussed rock in the Cape Colony and Natal, we must, to complete the story, now turn to certain Transvaal conglomerates, which, for some years past, have been known to show evidence of glacial action. Though much divergence of opinion has existed, even as to the nature of these rocks, various writers have with greater or less definiteness suggested their resemblance to, or connection with, the 'Dwyka.'

"Probably the conglomerate at Vereeniging was the first to come into notice, for it was in that neighbourhood that G. W. Stow, as far back as 1878, discovered the coal outcrops, which he describes as part of the 'Great Coal Field of the Vaal Valley,' and which were soon afterwards opened up by mining.[1]

"W. H. Penning, writing in 1891, 'On the Geology of the Southern Transvaal,' mentions a conglomerate, occurring east of Boksburg, near the base of the coal formation. Though he does not correlate it with the 'Dwyka Conglomerate,' Penning nevertheless ascribes this rock to the result of Palæozoic glaciation.[2]

"In A. R. Sawyer's *Report on Prince Albert*, mentioned above, reference is made (p. 11) to a 'bed of flint breccia fifty-one feet thick,' underlying the carboniferous formation at a depth of five hundred and sixteen feet at Viljoen's Drift, and the suggestion is put forward that this may correspond to the Dwyka Conglomerate. (Mr. Sawyer's words are: 'If this flint breccia correspond to the Dwyka Conglomerate. . . .')

"Bergrath Schmeisser, in 1893, found at Boksburg, on the farm Modderfontein, a rock which reminded him at once of an indurated boulder-clay, and which corresponded entirely to Schenck's description of the Dwyka Conglomerate of the Cape Colony and Natal. Schmeisser

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[1] *Report of the Geological Surveyor*. George W. Stow, Bloemfontein, 1878. *Report of the Geological Survey of the Orange Free State*, Bloemfontein, 1879. *Report upon the great Coal Field of the Central Vaal Valley*, by George W. Stow, printed by Witherby and Co. London, 1881.

[2] *Q.J.G.S.*, vol. xlvii. London. 1891. pp. 458 and 460.

also found *Schizoneura* and *Glossopteris* in other Transvaal collieries, and concluded, therefore, that the beds above the coal and the conglomerate are to be correlated with the Ecca shales of this Colony.[1]

"So far as I can find, Schmeisser thus gives the first clear correlation of these conglomerates with the Dwyka, and it is noteworthy that he was also able, by his discovery of plant fossils, to fix the age of the beds above the conglomerate, and correlate these with the Ecca Beds of the Cape Colony.

"Dr. G. A. F. Molengraaff, who paid his first visit to the Transvaal in 1890, wrote four years later of a conglomerate, lying unconformably above the dolomite, at Hartebeestfontein. He gives the following as occurring among the boulders: clay-slate, sandstone, banket (gold-bearing conglomerate), quartz, diabase, amygdaloid, quartz-porphyrite, dolomite, and other types of rock, the original site of which he did not know. A coarse loose sandstone lies above the conglomerate. A similar coarse conglomerate also occurs two kilometres west of Cypherfontein. The author states that although the conglomerates and boulder beds might belong to the coal-formation, still he is inclined to regard them as much younger, and to correlate them with the loose conglomerates which form a terrace on the eastern slope of Rhenosterkop, in the Orange Free State. Dr. Molengraaff had at that time no idea of their real character or age, for they obviously belong to the Glacial Conglomerate.[2]

"Further important palæobotanical evidence as to the age of the sandstone and coal beds above the conglomerate, and therefore of the conglomerate itself, was given in 1896 and 1897 by R. Zeiller[3] and A. C. Seward respectively. M. Zeiller describes certain plant remains sent him from Francis, three kilometres south of Johannesburg, and concludes, from the association of *Glossopteris Browniana* with its rhizomes (*Vertebraria indica*), *G. indica*, and *G. angustifolia*, a *Phyllotheca* and *Nœggerathiopsis Hislopi*, that the deposits at Francis, as well as those of Holfontein Colliery and Olifant River, are not of Stormberg, which from Dunn's 1887 map had been regarded as the age of the greater part of the rocks of the Free State and the Southern Transvaal, but of Beaufort, that is to say, Lower Karroo or Ecca age.

"Mr. Seward describes a series of fossils sent by Mr. David Draper, from (1) Boschman's Fontein and Maggie's Mine, in the Middelburg district, Transvaal, (2) Casey's Township (Francis), two miles south of Johannesburg, and (3) Vereeniging, about thirty miles south of Johannesburg. Seward found *Gangamopteris cyclopteroides* (a typical Ecca plant),

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"[1] Schmeisser: *Ueber Vorkommen und Gewinnung der nutzbaren Mineralien in der Südafrikanischen Republik (Transvaal)*. Berlin, 1895, p. 66.

"[2] G. A. F. Molengraaf: 'Beitrag zur Geologie der Umgegend der Goldfelder auf dem Hoogeveld in der Südafrikanischen Republik.'—*Neues Jahrb. f. Min.*, Beil.-Bd. ix., 1894. pp. 234, 238, and 239.

"[3] R. Zeiller: 'Etude sur quelques fossiles, en particulier, *Vertebraria* et *Glossopteris*, des environs des Johannesburg.'—*Bull. de la Soc. géol. de France*, 3e série, t. xxiv., 1896. pp. 349-378.

"A. C. Seward: 'On the association of *Sigillaria* and *Glossopteris* in South Africa.'—*Q.J.G.S.*, vol. liii., 1897, pp. 315-338.

and *Sigillaria Brardi*, in addition to some of those described by Zeiller, and concludes that the beds are of Permo-carboniferous age.[1]

"Sawyer again in 1897[2] referred to these Transvaal conglomerates in the following words:—'The writer has alluded to the possibility of this breccia (at the bottom of the coal-measures) being contemporaneous with the Dwyka Conglomerate, in his *Report on the Mineral Resources of the Division of Prince Albert*, in 1893, and the results lately obtained by him have not caused him to change his opinion.'

"Referring also to the conglomerate discovered by Schmeisser at Boksburg, Sawyer in this paper correlates it with the Viljoen's Drift breccia mentioned above.

"For some years past 'Dwyka Conglomerate' has been known to occur in the Vryheid district of the Transvaal.[3] In 1898 Dr. Molengraaff, who had been appointed State Geologist, made a somewhat extended survey of the district, and was fortunate in obtaining evidence which conclusively proved the glacial origin of the rock there. The conglomerate is described[4] by Molengraaff as resting unconformably on the 'Barberton Beds,' which consist of quartzite, sandstone, conglomerate, and granite, all of which show typical glacial striations and polished surfaces. The beds above the conglomerate are described as 'Ecca Beds,' and the author regards them as being without doubt the correlatives of the Lower Karroo Beds of the Cape Colony. No reference, however, is made to the marked difference in the relation of the Vryheid conglomerate to its underlying rocks, and that of the Dwyka Conglomerate of the Southern Karroo, which, as already stated, is always conformable to the Witteberg Quartzites.

"In the beginning of 1899, Mr. E. J. Dunn paid a short visit to Vereeniging and other parts of the Transvaal, devoting special attention to the conglomerate and its associated coal-seams. On the boulders collected from the conglomerate at Vereeniging by Mr. T. N. Leslie, Dunn observed numerous glacial markings, and adopted the view that all the Transvaal conglomerates, associated with the coals, are 'Dwyka Conglomerate.' On the map published with his paper, Dunn gives a new and continuous outcrop of what he names the 'Dwyka Coal Measures.'[5]

"Summarising what may be gathered from the above series of observations, the obvious conclusions are, (1) that the evidence of glacial action in the 'Dwyka Conglomerate' has accumulated to such an extent during recent years, that doubt can no longer remain that the rock owes its

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"[1] Mr. Seward (*Q.J.G.S.*, vol. liii., 1897, pp. 315) seems to misquote Schmeisser in stating that the latter speaks of the beds as 'belonging to the Stormberg series,' for Schmeisser distinctly points out that, from the plant evidence, the Lower Karroo Beds must be regarded as present in the Transvaal.

"[2] A. R. Sawyer: 'The South Rand Coalfield.'—Excerpt from the *Trans. of the Fed. Inst. of Mining Engineers*, p. 4. London, 1898.

"[3] David Draper: 'The Dwyka Conglomerate.'—*Trans. Geol. Soc. of S. Africa*, vol. i., pp. 90-103. Johannesburg, 1896.

"[4] G. A. F. Molengraaf: 'The Glacial Origin of the Dwyka Conglomerate.'—*Trans. Geol. Soc. of S. Africa*, vol. iv., part 1, pp. 103-115. Johannesburg, 1898.

"[5] E. J. Dunn: 'Notes on the Dwyka Coal Measures, etc.'—*Trans. So. Afr. Phil. Soc.*, vol. xii., part 1, pp. 67-74. Cape Town, 1900.

peculiarities to such action, and (2) that the Transvaal conglomerates, associated with the coal, are also unmistakably of glacial origin, and, from the fossil evidence found in the overlying rocks, can equally surely be regarded as being on the same geological horizon as the southern 'Dwyka.'

"Though the work of the survey of last year was not sufficiently extended to join up the Prieska Glacial Conglomerate with any of the distant outcrops mentioned above, little doubt can remain as to its actual position. It is nevertheless disappointing that no fossil evidence was obtainable as to the age of the shales above the conglomerate, similar to that so conclusively present in the Transvaal sandstones and shales at Vereeniging, Francis, and elsewhere. Still, one can piece together a considerable number of facts, gathered by the earlier observers, and arrive justifiably at the conclusion that the Prieska conglomerate underlies beds of the same age as the Ecca Series of the Southern Karroo. Apart from other considerations, it would be a strange, though not impossible, feature if there should be two instances of such perfect evidence as those of the Dwyka and Prieska Conglomerates, respectively referable to two separate Palæozoic Ice Periods. The fact that the Glacial Conglomerates of the Transvaal are at the base of the Ecca Series, as the fossils prove, is of considerable importance in enabling us to arrive at a conclusion as to the age of the Prieska Glacial Conglomerate, and it will, I think, appear, in spite of the fact that there has as yet been no joining up of the conglomerates nor of the overlying beds in the several localities, that sufficient evidence exists to show that they all are really of the same geological age.

"The evidence obtained by Messrs. Rogers and Schwarz, in the Prieska District, entirely bears out the glacial origin of the northern rock, though for full details of the long past ice-action we must look to still future researches.

"The Prieska work has not only brought forward incontrovertible evidence that the northern conglomerate is due to such action, as Stow and Dunn showed, but a comparison of the peculiarities there existing, with those of the southern 'Dwyka Conglomerate,' will throw much light even on the origin of the latter. The phenomena already observed are sufficient to enable one to decide the general relationship of the two conglomerates, and to render it apparent that we have here an extremely interesting, if not unique, series of Palæozoic glacial deposits.

"In the following paragraph I summarise the main facts observed by Messrs. Rogers and Schwarz during their northern tour, and must add that I rely entirely on their descriptions, and on the evidence afforded by their collection of specimens and photographs,[1] it having, owing to present circumstances, been impossible for me to visit the district. Their own detailed account will be found in Appendix III., to which I may here call special attention.

[1] Six characteristic photographs have been published to illustrate a paper, 'On the Orange River Ground Moraine,' by A. W. Rogers and E. H. L. Schwarz.—*Trans. So. Afr. Phil. Soc.*, vol. xi., part 2, pp. 113-120.

"The points of particular interest, discovered in the northern rock, may be arranged as follows:—

"I. As presented by the Conglomerate.

"1. Some portions are stratified, others unstratified.

"2. Boulders are abundant in the unstratified, absent or rare in the stratified portions.

"3. The size of boulders ranges from minute fragments up to blocks several feet in diameter.

"4. The boulders are angular, sub-angular, and rounded.

"5. The boulders are often facetted, and many are striated.

"6. The boulders are mainly recognisable as of local origin, though some are of types not yet found in the neighbourhood.

"7. The matrix also is finely fragmental.

"II. As presented by the underlying Rocks.

"1. The felsites and other older rocks form an irregular floor beneath the conglomerate; obviously they had been carved into hills and valleys before the conglomerate was laid down upon them.

"2. Rounded, polished, and striated hummocks—*roches moutonnées*—of the older rocks appear from under the conglomerate.

"3. The striations on the underlying rocks run in definite directions.

"4. These striations and polished surfaces are the more perfect on outcrops which have been the more recently stripped of their conglomerate covering.

"While all geologists will agree that the facts here summarised point unmistakably to pronounced ice-action, the history of glacial investigation, or rather controversy, in Europe and America, shows that there is likely to be less unanimity in ascribing the phenomena to the action of land-ice. It will be generally admitted, however, that we have a distinct parallel between the conglomerate, on the north of the Cape Colony and in the Transvaal, and some of the accumulations referred in Europe and America to the great Ice Age, and there will be little hesitation, on the part of the normal glacialist, to accept the Prieska Conglomerate as being what Sutherland in 1868 held the Natal occurrence to be, namely, an ancient boulder-clay.

"The phenomena presented by the conglomerate in the district surveyed last year, agree then with those discovered in 1898 by Dr. Molengraaff in Vryheid, and find a further parallel in the Vereeniging neighbourhood, although there I could find no striations on the surface of the exposed dolomite. The readiness of the limestone surface to yield to the action of sub-aerial weathering makes this a matter of no surprise, and, doubtless underneath the existing conglomerate, the protected surface of the limestone may still retain distinct striæ.

"The age of the various conglomerate outcrops can be best fixed by

the discovery of fossils, either in them or in the beds next above in normal sequence. It is unfortunate, as I have already said, so far as this important question is concerned, that the survey of the Prieska district has not yet been conclusive, no fossil evidence having been obtained which could throw light even upon the age of the overlying shales. Still, there is no lack of fossils in the rocks above the conglomerate at Vereeniging and elsewhere in the Transvaal, and I think one can even now piece together a fairly complete chain of evidence, which, if not irrefragable, will afford at least a considerable amount of proof that the Prieska rock is on the same geological horizon as the conglomerates in the Transvaal, and therefore of the same age as the Ecca or Dwyka conglomerate of the Southern Karroo. Absolute contemporaneity is not demanded, but, taken as a whole, the northern and the southern Conglomerates must, I believe, be regarded as belonging to the same geological epoch in the history of the region.

"In submitting the evidence in support of this view, it will be well if we consider first the question as to the continuity, or identity, of the numerous northern occurrences now recorded.

"Probably all the glacial conglomerate in the Transvaal is not continuous, and as many of the occurrences lie in ancient valleys carved out long ago in the older rocks, it may be that the want of continuity is original, and not entirely due to denudation. Frequently the conglomerate thickens and thins out within short distances—as South African geology teaches us to regard distance—and it may be found, now at the present surface, now close at hand in a hollow in the older rocks, covered over by a considerable thickness of coal, shale, or sandstone. All the fossil evidence in the Transvaal, however, is of the same nature, and, as has been pointed out in the foregoing review of our present knowledge, there is nowhere any inconsistency, but rather an accumulation of facts from different localities bearing out the view that the overlying sandstones or shales are of Ecca age. It appears, therefore, that no matter how discontinuous the conglomerate may be in the Transvaal territory, it is all on the same geological horizon.

"To the north of Kimberley, not far from Warrenton, Dr. Molengraaff informed me that, guided by some of Stow's observations given in the manuscript now in Johannesburg, he was able to satisfy himself that the same glacial polishing and striæ are to be found in the bed of the Vaal River as Messrs. Rogers and Schwarz subsequently found in the Prieska District, and certainly the specimens which I saw in the Museum at Pretoria admitted of no doubt. It is very probable, therefore, that there is virtually a continuation of the Vereeniging conditions right across the country to Kimberley, and thence westward to Prieska and beyond. As I have already said, it would be a curious feature if such evidence, connected as it seems at so many points, should belong to two totally distinct periods.

"Moreover, nearly all the northern outcrops, whether in the Transvaal or in the Cape Colony, reveal a marked unconformity with the underlying rock. At Vereeniging one sees it well; at Vryheid it cannot be overlooked; and one may infer from Sutherland's description that it

exists in Natal, while Stow's papers about Griqualand West quite agree with all that was met with last year at Hope Town or Prieska, which again confirms what Dunn describes at the junction of the Orange and Vaal Rivers in his report of 1886.[1]

"Although no proof as to an unconformity above the conglomerate was obtainable over the area surveyed in 1899, the Vereeniging evidence is rather important in this connection. In the coal mine one finds lenticular patches of conglomerate above the coal directly underneath the fossiliferous sandstone, while the floor of the mine, formed of the conglomerate itself, is more or less irregular. In the mine at Viljoen's Drift, about two miles south of Vereeniging, there is an alternation of coal and conglomerate beds which is particularly interesting. A core from that locality, which I owe to the kindness of Messrs. Goodwin and Leslie, of Vereeniging, shows a conglomerate, similar in colour but not so coarse as the Vereeniging one, alternating with several layers of coal and shale.

"I think that a similar alternation will probably be found elsewhere on the north, and it is extremely suggestive. It is very likely that there are local unconformities above the conglomerate, and that there is by no means everywhere a gradual passage into the overlying sandstone or shale, but this is a point which must remain for future investigation.

"However, so far as the evidence yet gathered together points, there does not appear to be any very marked unconformity above the conglomerate. At Hope Town the conglomerate passes up conformably into the shales, and, in Griqualand West, Stow describes it as passing into his 'Olive Shales.' At Kimberley the conglomerate underlies the beds known as the Kimberley Shales, which have yielded *Mesosaurus tenuidens*. A good section was recently exposed in the making of a new shaft at the Wesselton Mine, and I am indebted to my friend, Professor J. G. Lawn, for the following details:—

"'The conglomerate is 5 feet thick, and rests directly on the melaphyre, grey sandy shale above the conglomerate passing down to form the matrix of the latter.

"'In the De Beers Mine one section gives:

Conglomerate . . .	4″
Black Shale . . .	15″
Conglomerate . . .	18″

resting on the melaphyre.'

"This last evidence is interesting, as there has been frequent doubt thrown upon the real nature, and even existence, of the conglomerate at Kimberley. From the specimens sent me by Professor Lawn, I have no difficulty in recognising Glacial Conglomerate ('Dwyka Conglomerate'), the matrix being like that of the rock at Vereeniging, rather than that of any of the southern outcrops. The position of the conglomerate at

[1] *Report on a supposed extensive Deposit*, etc."

Kimberley is perfectly distinct, though the shaft section does not afford good evidence as to either an upper or lower unconformity. As, however, the conglomerate rests upon an amygdaloidal melaphyre resembling some of those seen by the assistant geologists west of Hope Town, the presumption is towards the existence of at least an unconformable lower junction.

"Summing up the facts as to the position of the several conglomerates and their relationship to the rocks beneath and above, we have then the following :—

"1. In Vryheid the glacial conglomerate, unconformable on the Barberton Beds, was observed by Dr. Molengraaff underlying Ecca beds. He had obviously no hesitation in recognising these.

"2 At Vereeniging the conglomerate lies unconformably on the Dolomite, and is overlaid (unconformably ?) by coal and sandstone containing various species of *Glossopteris*, *Gangamopteris*, *Noggerathiopsis*, *Sigillaria Brardi*, etc. ; that is, these beds are of Ecca age.

"3. In the Kimberley mines the conglomerate underlies the Kimberley shales, which have yielded *Mesosaurus tenuidens*, and are generally accepted as being the same as the Ecca beds.

"4. The Griqualand West Conglomerate is described by Stow as intimately associated with his 'Olive shales,' which are generally regarded as being at the same horizon as the Ecca shales.

"5. The Hope Town Conglomerate is described by Dunn as passing up into the shales.

"6. The observations made during last year by Messrs. Rogers and Schwarz point also to the (conformable ?) passage into the over-lying shales.

"7. Dunn, in his 1886 report, as already quoted, gives a continuous outcrop for the conglomerate from Hope Town right round the north and west of the Karroo to Matjesfontein, and on the west and south, there is no doubt as to the 'Dwyka conglomerate' lying beneath the Ecca beds.

"We may therefore have no hesitation in accepting all these conglomerates as belonging to the same geological horizon, namely, the base of the Ecca Beds, but while the southern outcrops lie conformably on the Witteberg quartzites or on the intervening shales, there is always on the north a marked break beneath the conglomerate, which everywhere lies unconformably on beds older at least than the Witteberg series of the south. This difference in relationship to the underlying rocks between the northern 'Glacial Conglomerate' and the 'Dwyka' of the southern Karroo is of great importance, as indicating not merely a difference in the formation of the two sets of rocks, but also as pointing to the probable presence of a unique record of Palæozoic glaciation.

"But, while the presence or absence of a conformable junction with the underlying rocks is the prime fact in leading to a decision as to the mode of formation of such glacial conglomerates, there are other differences which cannot be overlooked, and which all point to the same conclusion. These differences may be summarised as follows :—

"Southern 'Dwyka Conglomerate.'	"Northern 'Glacial Conglomerate.'
"The 'Dwyka' is separated from the Witteberg Beds by plant-bearing shales, exactly the same as those between and above the actual conglomerate beds.	"In all the Prieska localities, at Kimberley, at Vereeniging, and at Vryheid, the conglomerate rests directly on rocks older than the Witteberg series.
"The junctions both above and below the Dwyka are conformable.	"There is a marked unconformity beneath, and in some places probably also above, the northern conglomerate.
"The Dwyka is distinctly bedded. (Owing to the shearing and twisting of the beds along the base of the Zwartebergen the bedding is obscured in places.)	"Bedding is much rarer, in fact, generally quite absent.
"The Dwyka boulders are of distant origin—some of them being from rocks now known in place on the north.	"The boulders are generally of distinctly local origin.
"The Dwyka presents a uniform petrographical character, from Matjesfontein round to Grahamstown.	"The northern conglomerates vary, but yet are of a common type distinct from the Dwyka.

"As characters common to the Dwyka and the Glacial Conglomerate, we have, on the other hand, the fact that a large percentage of the boulders in both show glacial striæ, and that pieces of the same rocks may be found in each.

"So far no attention appears to have been paid to the importance of the fact of the unconformity beneath the conglomerate on the north, while on the south there is a perfectly continuous passage from the Witteberg Beds, through the Dwyka, to the Ecca sandstones and shales; that is to say, a conformable succession through several thousands of feet of strata, implying continuity of deposition, marked, however, by one peculiar phase, when, in addition to the more normal sediments, glaciated boulders were carried far south and dropped irregularly among the accumulating muds. Certainly the unconformity on the north points to very different physical conditions from those indicated by the conformable sequence of Witteberg Quartzites upwards to Dwyka Conglomerate and Ecca Shales on the south.

"The conclusions to which I regard these facts as pointing, are, (1) that the northern rock is the result of terrestrial glaciation—it has all the characters in itself, and in relation to the underlying rocks, which a ground-moraine shows, it is therefore the result of prolonged glacial action on a northern land surface in late Palæozoic times: (2) that the

'Dwyka Conglomerate,' on the other hand, is a sediment formed under a probably inland water, into which there floated the icebergs calved from the front of the glacier or glaciers on the northern shore. These carried with them the glacial debris and the striated boulders which now form the conspicuous feature in and reveal the story of the southern conglomerate.

"As the climate became milder the ice diminished and retreated from the actual shore of the lake, leaving behind it the usual accumulation of morainic material, such as may be seen to-day in Alpine valleys. Icebergs no longer floated so far southward with their freight of boulders, but the streams from the melting glacier carried down silt and minute debris which accumulated as shales above the mixed conglomerate on the bottom of the lake. It is probable, from the frequent conformable passage of the conglomerate into the overlying shales, that the retreat of the glacier was further accompanied by local submergences of the northern land surface.

"The evidence in the sandstone above the conglomerate at Vereeniging and elsewhere in the Transvaal, is interesting in this connection, for one often finds large boulders right in the centre of a bed of fine-grained sandstone. Some of the buildings in Johannesburg are rather disfigured by the presence of such 'erratics' in the hewn sandstone blocks.

"That is to say, then, that while the material for the two conglomerates may be referred to the same cause ultimately, the conditions of deposit were entirely different. The southern Dwyka was being laid down under water, while on the north the land was buried in ice which ground and smoothed the old rock surfaces into typical *roches moutonnées* and filled up the hollows with a clayey ground moraine. It could be only on the northern retreat of the ice that the ground moraine, or glacial conglomerate, became more or less as we now know it. Consequently, while, taken as a whole, the two conglomerates may safely be regarded as contemporaneous, the northern one may, at some particular place, have still been forming, while, on the south, the shales overlying the conglomerate were being laid down as fine mud, derived from the northern glacial shore.

"The conditions under which the northern and southern conglomerates were laid down would correspond, say, to those prevailing to-day in Greenland and its surrounding seas, and a complete parallel, except perhaps so far as the nature of the water is concerned, is obtained when we consider what would happen if the front of the Greenland ice-sheet were to retreat inland away from the shore. The marine deposits at present forming around the Greenland coast contain ice-carried boulders irregularly dropped among the accumulating sediments, but if the ice were to retreat far inland, only fine mud would reach the sea, while the glaciated boulders would be left behind as the terminal moraine of the ice-sheet. Such, it appears, must have been the sequence of events while the Karroo was still a great inland water, whose shores was the haunt of those antique forms of reptilian life which we everywhere discover as fossils in the now solidified sands and muds. Marvel-

lous, however, as is the perfection of this record of such long past times, there is much to be done before the full story can be deciphered.

"We are still ignorant of the position of the probably receding shore-line which must have marked the boundary between the northern land-formed deposit and the southern subaqueous one. We have not yet discovered the ancient coast-line, which should be indicated by the passage of the land-formed ground moraine, or unconformable 'Glacial Conglomerate,' into the conformable 'Dwyka Conglomerate,' or subaqueous silt with its foreign boulders, laid down under quiet waters, south of the glacier front quite conformably on the Witteberg Quartzites. It is probable that sufficiently good outcrops exist along the western side of the Karroo to reveal this passage of unconformable 'Glacial Conglomerate' into the conformable 'Dwyka,' and thus mark the position of a portion at least of the ancient shore-line. To discover if such evidence is obtainable will be part of our work in the immediate future."

AMID THE SNOWS OF BALTISTAN.

By Fanny Bullock Workman, F.R.S.G.S., M.R.A.S.

A party, consisting of Dr. W. H. Workman, Mattia Zurbriggen, myself, and about fifty coolies and servants, left Serinagar, Kashmir, on July 1st, 1899, and passed by the upper Deosai route to Skardu and Shigar. Thence crossing the Skoro La (17,000 feet) in three marches, we reached Askole, in Braldu, at the foot of the Biafo, Punmah, and Baltora glaciers.

The Skoro La is one of the most beautiful and varied of the many mountain passes which we crossed during our two summers in high Asia. We were told at Skardu that it was still too early in the year to cross the Skoro La; but we had not much faith in the opinions of the valley people, and decided to open the pass for the season, if, indeed, it had not been crossed already.

Two or three hours' march from Shigar brought us to Askor Nullah, a village shaded with apricot-trees, at the opening of a wild ravine leading to the pass. A considerable time was lost here by our servants, and it was nearly ten o'clock before we succeeded in entering the ravine. The trail winds under high precipices, and sometimes climbs over the steep faces of adjacent rocks; and we had to ford the Askor torrent twelve times before reaching the base of the pass.

Askole has been aptly called "the world's end"; the name is given to seven villages scattered about the valley, each having its own lambardar or chief. The principal collection of huts, connected with the outer world only by a flimsy rope bridge and the trackless ice rivers towards Hunza and Turkestan, stands in the last dot of green on the ragged edge of a world of rock and snow. The bridge which spans the Braldu river, at a width of 270 feet, is one of the longest and most trying in the country.

In Shigar the Askole people are spoken of as Braldu men. The

Mt. Koser Gunge, from the Shigar Valley, 21,000 feet.

The above illustration is reproduced by permission of T. Fisher Unwin.

Askole valley is in the province of Braldu, but the Braldu inhabitants are very similar to the Baltis, dressing like them, and, so far as we could learn, speaking the same language. They are of Tibetan origin though Mohammedan in religion; they are cheerful and garrulous, and are naturally good mountaineers, although, like the Kashmiri, they prefer to huddle round a camp fire and gossip all day.

We proposed to follow up the Biafo glacier for more than thirty miles to the Hispar pass; this was not a common undertaking for the Askole people, and three days had passed before the lambardars had assembled coolies and collected the necessary provisions. No European

Peaks on west side of Biafo Glacier.

had been there since Sir Martin Conway and his party had descended the glacier in 1892. The chiefs seemed to be all new men, and the only souvenir of the Conway party was Sir Martin's *chit* of reference, which was handed to us by Lambardar Kinchin, who was to be chief of our band. He had not been with Sir Martin Conway, but he now owned the testimonial, and, as he spoke Hindustani, was to act as interpreter as well as leader of the men. He wore the cast-off coat of a Sahib, and carried a cotton umbrella. He failed as a disciplinarian, but never lost his dignified demeanour.

We left Askole on the 16th of July. Two hours' march brought us to the beginning of the glacier, where all paths cease, and the tiresome moraine work common to all great glaciers begins. A recession of the

snout of the glacier has taken place in late years. Colonel Godwin Austen tells us that in 1861 the end abutted against the cliffs of the south side of the Askole valley; now, it only reaches the line of the north side. Zurbriggen, who was with the Conway party in 1892, also found great changes in the first twelve miles of our route; it had become much more heavily crevassed and broken into séracs, and consequently was more difficult to explore. We ascended the high lateral moraine at a point over a mile from the end of the glacier, thus shortening our distance and obtaining an early foothold on the ice. The march continued all day over great truncated séracs, divided by deep crevasses. The ice, though often very slippery, was generally concealed by a varied covering

Mount Meru.

of detritus of mud and sand. Boulders of granite, white quartz, sandstone, and shale lay all about, sometimes bridging the crevasses. We made fair headway; towards night we left the glacier, climbed to a high alluvial terrace, and encamped at a height of 11,775 feet.

The next day, as we attacked the glacier, we foresaw hard and slow work: giant honeycombed séracs rose as far as the eye could reach, and a light covering of new snow lay over ice and detritus. The crevasses were longer, wider, and seldom spanned by bridges. We sought for a passage not far from camp, but found none on that side; we then crossed to the centre and tried our fortune amid a reach of séracs rising like a huge white tongue fifty feet or more above our trail. We had to spend several hours cutting steps over and around them.

After losing much time we succeeded in bringing the coolies through, until we came upon two specially high séracs separated by a profound crevasse. On the side of one of these Zurbriggen had to cut a gallery fully thirty feet long. A number of the older coolies began to remonstrate and talk of returning; but a firm reply restored discipline. Owing to the projection of the icy walls, the coolies could not follow loaded, so that the loads had to be handed through the passage first. To accomplish this, Kinchin and our bearer were placed in the gallery to hand the packs—some of which weighed sixty pounds—to Zurbriggen, who stood at the most precarious point, with one leg across the crevasse and his foot braced against the opposite sérac; he passed them on to

Mount Kolahoi, Lidar valley, 17,839 ft.

two camp servants standing on a lower shelf. Last of all came two sheep, which were to serve as food; one was landed safely, the other, carelessly handled, slipped into the crevasse. Zurbriggen insisted that he should be lowered on a rope, and succeeded in recovering it unhurt.

We next reached a couloir, through which we pushed as fast as possible, but soon came to a flat ice surface where we were confronted with huge bridgeless crevasses which could not be jumped. As the weather was thickening, the day advanced, and the guide unable to find a passage, we decided to return to the old camp for the night. There we remained during the following day while Zurbriggen and Kinchin made a reconnaissance: at last a bridge was discovered near the point which we had left.

On July 19th we passed the great sérac belt by noon, and came to a fairly smooth surface along the middle of the glacier; we tried to find a place for encampment on the right bank, but had at length to cross to the other side, and spent the night on a stony plateau at an elevation of 12,900 feet. On July 20th we came to Boggy Camp, 13,650 feet high, on the west bank—a sandy hollow at the entrance of a nullah leading to a group of snow-peaks. Here we passed four days; and as this is the last point at which wood may be found, we employed the time in sending wood to Ogre Camp for future use. On the 25th July we broke camp, and after an hour over rough moraine reached to centre of the glacier.

Ogre Camp.

Before we reached the Ogre Camp, the Ogre came into view. The camp is situated on a southern spur of one of the most beautiful of the mountain massifs. It consists of a small grass-covered projection from a rock slant, and overhangs the glacier. Opposite is a huge faleric of granite walls and peaks, which we named the Biafo Walhalla; it splits midway from its base into spires and domes rising to 21,000 and 23,000 feet.

From the mountain rising to the north of Ogre Camp, several peaks attain a height of 23,000 feet, and two glaciers descend to the Biafo. About six hours above this camp the Biafo opens into Snow Lake, a vast basin of ice and snow, encircled by unnamed peaks. We pursued the

gradual ascent from Ogre Camp to the entrance, which is at an elevation of 16,000 feet. The march was slow and trying; at last we reached an ice slant, where each step had to be cut; and late in the afternoon encamped on a narrow ice shelf (16,450 feet) at the base of a rocky cliff. Here a packet of fagots, which we suppose to have been left by the Conway party in 1892, was found.

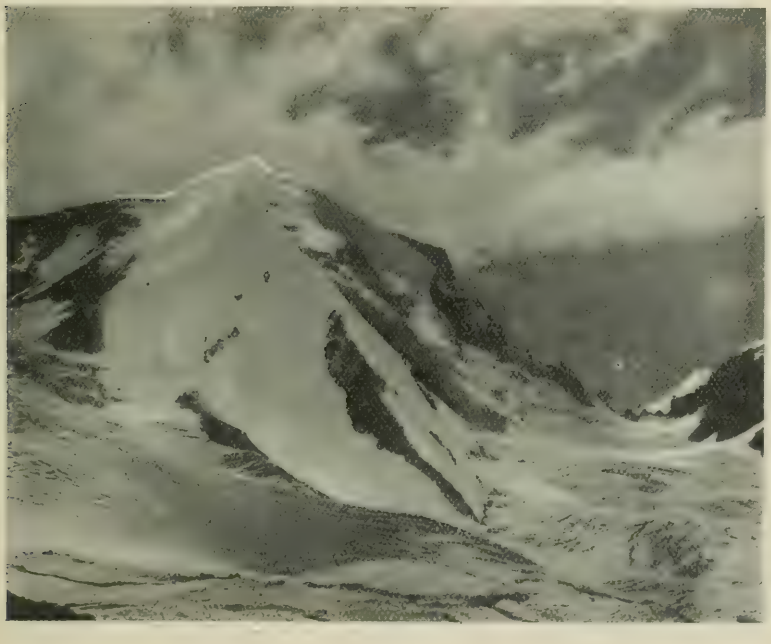
The next morning we started for the Hispar pass. The ascent led first over a long snow slope, and later over a sharp crest; it was necessary to make several detours in order to avoid certain wide crevasses. One of the latter assumed almost the shape of an ice cañon. We reached the top of the pass (17,435 feet) at 8.30. It is an ice defile, bounded on both sides by peaks. To the south is a range which culminates in the peak "B. 15," whose height has been determined by the Trigonometrical Survey at 23,900 feet; this peak bounds on the south-west a long arm of Snow Lake. Colonel Godwin Austen sketched "B. 15" from a height above the Punmah glacier in 1861; we called the summit Mount Kailasa.

On the following day we descended to Ogre Camp in a snowstorm, and left it the next morning; by nine o'clock we were crossing the glacier in four inches of snow. We returned to Askole in long marches, descending in half the time which it took to ascend. The seven lambardars in their best clothes, together with the ladies of Askole, stood on the house-tops to welcome our entry into the village. Here we remained for two days, to rest and to enlist coolies for the next trip.

On August 5th we left Askole for an exploring tour in the Skoro La range, with thirty coolies under Lambardar Kinchin. He still carried the cotton umbrella, now much battered, but had added more substantial clothing to his outfit, in order to meet the varied temperatures which he had learned to expect. Again crossing that unpleasantly mobile rope bridge, we climbed the south wall of the valley to the nullah leading to the Skoro La. Following this up to the limit of wood, we encamped at an elevation of 14,200 feet. As the peaks came in view, we selected the first horn to the east of the pass as our objective, and decided to press towards it on the following day. We forded several torrents, and crossed the glacier, bearing up the crest of the right lateral moraine. It was narrow and steep, and ascended sharply towards another fine glacier which descended in chaotic séracs from the circle of summits above. When they saw the nature of the country for which we were heading, the coolies began their usual refrain: "Please, Sahibs, go back to wood and grass." This, of course, we refused to do. We attempted to cross the higher glacier in order to make an ice camp, but the men continued to clamour, and finally threw down their loads and refused to move farther. We therefore had to pitch on the border of the ice. The moraine ledge was barely safe from boulders falling from a great peak behind, but we made the coolies build up rock terraces for the tents.

At five in the morning of August 7th, accompanied by two of the more courageous coolies as porters, we crossed the glacier leading to the base of our peak. An ordinary Swiss guide would have been puzzled,

and might have lost some hours in finding his path through the maze of séracs and crevasses which faced us. But Zurbriggen was not one of these. He led us in and out and over them, as though he had been following a well-remembered path. In less than three hours we had conquered the séracs and were breakfasting on a sloping plateau. Thence some steep slopes of the peak were ascended, and above these there came an hour's rough climbing over rock slabs. Then the final snow slopes began, after which we reached a lower rock summit. Here our porters, who had continued to complain of their loads, threw themselves upon the ground and were fast asleep in two minutes, while we



The Siegfriedhorn.

went on to the main top, which is a narrow snow cornice. We had come from the camp to the summit in five and a half hours. The height—taking the average of the Watkin Patent and the Carey aneroids—was 18,600 feet. The view was very fine: ridge after ridge of Karakoram and Hunza peaks rose to the north and east; among them Masherbrum was clearly seen. We named this peak the Siegfriedhorn. The porters built a strong cairn on the lower rock summit which crowns a ragged shaly wall that falls several thousand feet in a sheer precipice on the Shigar or south side.

Weather detained us two days at Avalanche Camp. We intended to attempt a beautiful white cone, the fifth from Siegfriedhorn, and the first of three snow-corniced peaks which we named the "White Fates."

The glacier descending from this peak was deeply crevassed, and broken into thousands of séracs of great size. The height of one ice-fall above our tents was at least 500 feet. We might perhaps have ascended over its side, but coolies could not be taken through, and a higher camp for the final climb was necessary. Zurbriggen went out during our detention at camp to see what might be done. He decided that an exceedingly steep talus to the left, descending from a rock peak, would have to be ascended, and that then we should have to traverse a rock shoulder exposed to falling stones.

On the morning of August 10th we started, with only a few men, and the barest camp necessities. After struggling for an hour over a

Summit of the Siegfriedhorn, 18,650 ft.

sharp moraine and the abrupt talus, we had great difficulty with the coolies. At last we got them over the rock shoulder, where we were all for twenty minutes in imminent danger from falling stones, and reached a spot on the glacier which we had selected for a camp from the summit of the Siegfriedhorn. This was the best of our very high camps; it stood at an elevation of 17,375 feet, on ice lightly covered with moraine. The ascent was continued on the 11th at 6 A.M. A reach of moraine and glacier brought us to a bold crevassed slope which led to higher snowfields. The surface was very icy, and step-cutting began immediately. We were roped from the first; as we ascended in zigzags to an icy snout overhanging a basin a thousand feet

below, Zurbriggen continually called to the coolies to move carefully and to keep the proper length of rope between them. His advice was given in a polyglot dialect of German, Hindustani, and English, which made no serious impression on the porters, for they sat down at a critical point to remove snow from their boots. There was no rock work, the ascent being from the first over a succession of ice and snow slants. The last arête, about 400 feet in height, rose at an angle of about 60°, and proved long and laborious, as the new snow lay fifteen inches deep.

We attained the summit (19,450 feet) at 10 A.M., thus completing the ascent which began at Avalanche Camp eight hours below. Considering the rock climbing between the two camps and the combined ice and snow work from our last night's camp to the summit, this mountain proved much more difficult than the Siegfriedhorn, and may be classed, according to Zurbriggen, among peaks of the first order, even in that land of giants. This peak was named Mount Bullock Workman. Looking over the edge towards the east, we saw a large glacier which swept far away among escarpments of wild peaks; this we named Crescent Glacier. Its lower part is indicated on the Indian Survey Map, but not the upper part, which we were the first to photograph. From the peak on which we stood was seen "K. 2," the second highest summit in the world; and to the north-east, beyond Mungo Gusor, overtopping lesser hills, appeared the peaks "B. 15," "D. 16,' and "No. 11." On examining the original drawings made by Colonel Godwin Austen in 1861, we found that the forms sketched by him corresponded almost exactly with our photographs.

Our third ascent was the highest. On August 12th we recrossed the Skoro La on the way to the Shigar valley. Ever since we had left Shigar, early in July, a grand white dome, facing the valley to the north, had strongly attracted us. We had seen it from Mount Bullock Workman, surmounted by a higher peak. The massif, with its chief peak, Koser Gunge, is shown on the Indian Survey map of the Shigar valley.

We made two marches up the valley to Yuno, whence we had determined to make our attempt. From this village 5000 feet of steep earth and grass slopes, followed by 6000 more of rock wall, end in a broken arête, above which a small part of a snowy height is seen. Zurbriggen crossed to the other side of the narrow valley to see if a better view of the mountain could be obtained; for we were not then sure that the summit had been seen. He made up his mind upon that point; and we waited three days while coolies were gathered from the scattered villages.

On August 20th, with a not very promising sky, we started from Yuno in search of our first camp. After seven hours' stiff climbing we came to a grass ledge which had been selected from the valley. This knoll, at 14,600 feet, proved a comfortable place. The day was fine at sunrise, but by eight o'clock misty clouds had covered the lower or dome summit. As the route lay entirely over rock arêtes to the snow, and could not be attempted in doubtful weather, we were kept in camp all

that day and the next. On the third morning the barometer made a leap upwards, and Zurbriggen set out to find a place for camp. But the day turned to hail, wind, and thunder, and the guide returned toward night, angry with the weather, the great cold, and the slippery condition of the rocks.

The fourth morning was fine. Sun burned upon the range, and the snow was rapidly melted. But when the coolies were called, they came slowly forward and stood sullenly gazing upon their loads; and, when ordered to move, they bolted down the mountain side. We sent an embassy to the place where the men halted on a lower spur, and it was

Summit of Mount Bullock Workman, 19,450 ft.

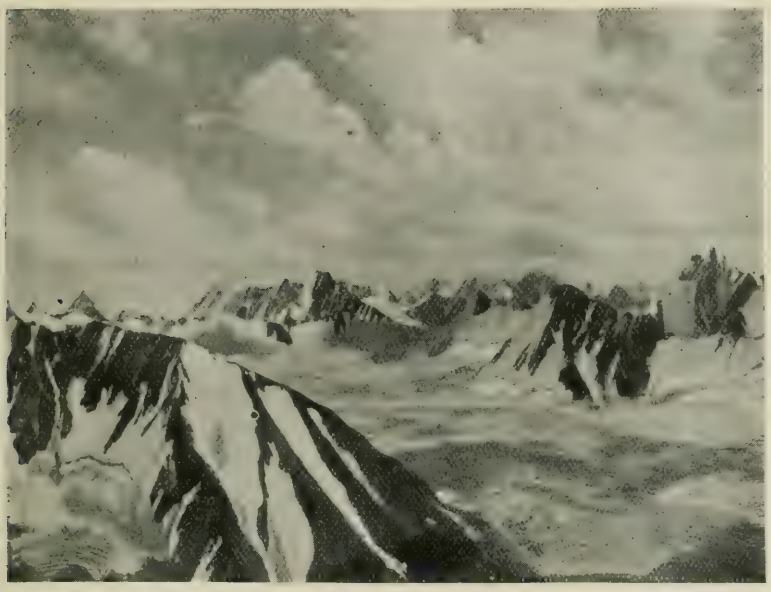
only after an absurd bribe had been offered that thirteen of them agreed to carry our tents to our highest camp.

This was a wild, windswept, sloping, rock-covered plateau at 17,900 feet, at the foot of the bare wall which we were to attack on the next day. It was a cheerless *gîte*, but we were fortunate enough to find water in a rocky couloir near by.

A tent servant and a Kashmir coolie accompanied us on the ascent, for the Shigar coolies possessed no sufficient clothing. The morning was fair but windy. For the first 1200 feet we had some severe rock work on the wall; and then a steep arête leading to a horizontal one had to be overcome. Thence we passed along a narrow shelf forty feet in length, projecting from a rock mass overhanging an abyss, to a snow basin. At this point no summit could be seen; there was only a long

snow slope leading to another ridge. We stopped for a light breakfast. The sun shone fitfully between heavy clouds, and it grew very cold. The wind blew strong in our faces from the moment that we touched snow.

When we reached the ridge the summit was still invisible; a shoulder and another sharper slope cut off farther prospect. The snow became deeper. The second slope led to a huge arête, rising at an angle of fully 55°, and so placed as to bring us more directly in the teeth of the wind. The cold became intense, not so much because of the low temperature (14° Fahr.) as because of the relentless wind, which, with the highly rarefied air, greatly impeded our progress.



Crescent Glacier from Mount Bullock Workman.

By noon we had reached an elevation of 20,000 feet; the snow came to our knees—snow dry and mealy, which so chilled and benumbed our feet that we expected frost-bite. The surface beneath the snow was of ice, making our footing on the sharp slants very insecure. Zurbriggen worked hard, treading out every step; and the waiting for him to do this was bitter. The mere lifting of the feet from one deep step to the next made us pant for breath. We needed food but could not find it with half-frozen fingers. I called to Zurbriggen that I must change my gloves, for I could no longer feel my ice-axe; but he scarcely heard the loudest shout at the end of thirty feet of rope. We halted while he rubbed my hands and pounded my feet as well as he could.

We came, in time, to a knife-like edge, where the snow was hurled

in stinging gusts in our faces; and there, at last, we saw the final peak, a high snow cone with a blue ice cornice, emerging from a cloud. It was still some hundreds of feet above, and separated from us by a small snow lake and another arête. The distance seemed great, insurmountable. We descended, crossed the basin and attacked the slant in zigzags. The snow portion of Koser Gunge proved to be not one peak only, but a system of slopes and domes.

On the last dangerous incline our Kashmiri porter gave out, and sat down, turning his back to the roped train. There was a pull on the rope; looking up we saw Zurbriggen, with icicles two inches long hanging from his beard, waving his hands and calling. As we could hear nothing distinctly he came close to us. We ordered the servant to unrope the coolie. It was several minutes before the man was released, and we saw him crawl downward. Benumbed by the halt in the wind and cold, we plodded on, and our goal was reached at three o'clock. One of our aneroids registered a hundred feet under, the other a hundred and fifty feet over, 21,000 feet. The thermometer indicated 10° Fahr.

We hurried down as fast as the difficult conditions would permit. That descent in the still raging storm to the boundary arête was not easy; and it was quite two hours before we reached a place where a short meal could be taken. Here we found the coolie trying to keep warm behind his load.

A word may be added with regard to our measuring of altitudes. The chief aneroid used during the expedition was a Watkin Patent barometer graduated to 24,500 feet, which, so far as we could judge, worked with great accuracy. The highest pressure at all stations where there was opportunity for taking a series of readings—and consequently the lowest altitude—was adopted as probably approaching most nearly to the true altitude. In several instances the heights corresponding to our readings were a good deal lower than those given by others and indicated on maps. One pass marked on the maps as 15,900 feet was measured by our Watkin as 15,425 feet. We do not claim that our altitudes are exact; but if the points to which they relate are ever fixed by the Survey, we think that they will not be found to differ greatly from the altitudes which we have given.

REVIEW OF THE ALASKA BOUNDARY QUESTION.

By Alexander Begg, Author of the *History of British Columbia*.

(*Continued from page* 30.)

In an article on the Alaskan boundary, which appeared in the November (1899) number of the *National Geographic Magazine*, the Hon. John W. Foster, ex-Secretary of State for the United States, is represented as stating that "much of the difficulty on reaching an agreement on this point (the correct location of the boundary-line) grew out of the

imperfect geographic knowledge of the period." That need not follow, for Mr. Foster admits and writes that "in 1792-95, George Vancouver, under the direction of the Admiralty, made the first accurate and scientific survey of the north-east coast of America, and his charts were published in 1728. These charts were for more than a generation the basis and source of information of all maps of that region."

Mr. Foster, delineating the first section of the treaty of 1825, quotes Article III., and states, it provides that "commencing from the southernmost point of the island called Prince of Wales Island, which lies in the parallel of 54° 40′ north latitude, . . . the said [boundary] line shall ascend to the north, along the channel called PORTLAND CHANNEL, as far as the point of the continent where it strikes the 56th degree of north latitude."

The foregoing quotation from the treaty should be enough to satisfy Mr. Foster that, as the treaty expressly and plainly says, the boundary should commence at the southernmost point of Prince of Wales Island, and shall ascend to the north, etc.; it is impossible to reach 56° on the continent by the line indicated in the treaty by going *east* to Portland Canal, which is not mentioned in the treaty; neither is there any authority in the treaty of 1825, to commence the boundary line at Cape Muzon, as it has been drawn on the States official charts and maps, although Cape Muzon is situated on Dall Island, to the west of Prince of Wales Island, and may yet be claimed by Great Britain as belonging to Queen Charlotte Islands, immediately opposite across Dixon entrance.

"The United States holds," Mr. Foster further states, "that under this provision the line starting from the extremity of Prince of Wales Island, shall enter the broad, deep, and usually navigated opening of Portland Canal . . . and pass up to its head, and thence on the continent to the 56th degree of latitude." There is nothing in the treaty to indicate such a course; besides, the opening of Portland Canal (or Channel as Mr. Foster is pleased to name it) is seldom navigated, as it is a *cul de sac*, and there is no trade in that direction. In the same paragraph, Mr. Foster undertakes to define "the present contention of Great Britain," which, he says, is understood to be "that the line from the extremity of Prince of Wales Island should enter the tortuous and narrow channel, now known on the British admiralty charts as Pearse Canal, and thence up Portland Canal to the 56th degree; thus placing Wales, Pearse, and a few small islands in British territory."

No such contention has ever been published or advocated by any party having authority in Canada or Great Britain to adopt such a route, which is entirely opposed to the wording of the treaty; and the statement or contention said to be held by the United States, that the line should "enter the broad, deep, and usually navigated opening of Portland Canal" is entirely fallacious. Neither have those who have examined the question in an unbiassed manner, ever thought of the boundary line going east by way of Pearse Canal or by Portland Canal. The contention of British subjects who have studied and become acquainted with this boundary question is, that the line should, from Cape Chacon, follow Clarence Strait, *north*, nearly along the 132nd meridian, and in accord-

ance with the description given in the treaty until opposite Ernest Sound, when it runs eastward through Ernest Sound, until it reaches the coast of the continent at 56°, as specified in the treaty; thence returning westward to the boundary already formed from Cape Chacon, along the east coast of Prince of Wales Island, it follows the coast of the island to its northern end; thence following a conventional water boundary, ten marine leagues from the ocean, as required by the treaty, until the continental shore of the North Pacific is reached, and then along that coast, ten marine leagues from the ocean, to the 141st meridian, and thence along that meridian to the Arctic Ocean.

This brings us to a late date in the review of this boundary question. The joint commission which had been appointed to determine the line between Alaska and Canada met at Quebec, and discussed the question for weeks, without being able to agree on a settlement, so they adjourned *sine die*. They met at Washington, D.C., in February 1899, but found they were still unable to agree on the question. The British commissioners proposed it should be referred to arbitration, and that an "arbitral tribunal" be immediately appointed, to consist of three jurists of repute, one on the part of Great Britain, one on the part of the United States, and of a third jurist to be selected by the two persons so nominated, to be governed by the following rules:—

(*a*) "Adverse holding or prescription during a period of fifty years shall make a good title. The arbitrators may deem exclusive political control of a district, as well as actual settlement thereof, sufficient to constitute adverse holding, or make title by prescriptions."

(*b*) "The arbitrators may recognise and give effect to rights and claims resting on any other ground whatever, valid according to international law, and on any principles of international law which the arbitrators may deem applicable to the case, and which are not in contravention of the foregoing rule."

(*c*) "In determining the boundary-line, if territory of one party shall be found by the tribunal to have been at the date of this treaty in the occupation of the subjects or citizens of the other party, such effect shall be given to such occupation as reason, justice, the principles of international law, and the equities of the case shall, in the opinion of the tribunal, require."

The commissioners of the United States accepted the foregoing proposals made as the basis of adjustment, but desired the rules modified as follows:—

Rules (*a*) and (*b*) to stand as submitted, but (*c*) to read as below:—"In considering the 'coast' referred to in said treaties, mentioned in Article III., it is understood that the coast of the continent is intended. In determining the boundary-line, if territory of one party shall be found by the tribunal to have been at the date of the treaty in the occupation of the subjects or citizens of the other party, such effect shall be given to such occupation as reason, justice, and the principal of international law shall, in the opinion of the tribunal, require; and all towns and settlements on tide-water, settled under the authority of the United States, and under the jurisdiction of the United States at the date of

this treaty, shall remain within the territory and jurisdiction of the United States."

In reply, the British commissioners stated that they were "absolutely unable" to accept the change in rule (*c*), and said:—"In considering the 'coast' referred to, while it was probably intended by this clause that the line should be drawn upon the continent, the language used is open to misconstructions." They also objected to the words added, "that all towns or settlements on tide-water, settled under the authority of the United States," as being a marked and important departure from the rules of the Venezuela boundary reference, and could not be adopted.

Referring to the arbitral tribunal proposed by the United States commissioners, which was to consist of six impartial jurists, three on the part of Great Britain, and three on the part of the United States. The United States commissioners were of opinion that the selection of an umpire should be made from the American continent. It was finally agreed by and between the commissioners that all subjects before the joint commission should be referred to their respective governments. The commission then adjourned and separated.

Since the appointment of the joint commission of the Washington Convention of 1892, which was formed "with a view to the ascertainment of the facts and data necessary to the permanent delimitation of the boundary line from latitude 54° 40′ northwards to the 141st degree of longitude, in accordance with the spirit and intent of the existing treaties in regard to it between Great Britain and Russia, and between the United States and Russia," great and important changes have taken place in those northern regions. The valley of the Yukon has been found to be one of the richest gold-producing districts in the world. Lynn Canal, as the most available route to the Yukon country, has been adopted, with Skagway as the gateway to the Klondike and Dawson. Hundreds of thousands of miners and others crowded there in 1897-8, in the face of extreme danger and difficulty.

In the meantime another rich gold-mining district was found in the northern part of Cassiar, British Columbia, near Atlin and Teslin lakes. A prospecting party, by way of Juneau, came through there in 1898 to Atlin lake and discovered, in that neighbourhood, rich gold diggings. Other parties soon followed, and before winter set in over a hundred thousand dollars had been mined. An Act of the Legislature of British Columbia (the Alien Acts) prohibiting miners not subjects of Great Britain from gold-mining in British Columbia—under certain restrictions. This prevented a large number of intending miners from taking up locations in the Atlin district, and limited the output of 1899, yet it is computed to reach fully one and a half million dollars.

Intending miners, therefore, took up claims in the Porcupine district, within the boundary strip claimed by the United States. They made their headquarters at a small Indian village, Klukwan, fifteen miles from tide water, at the head of Chilcat inlet, a branch of Lynn Canal. A *modus vivendi* has been passed on the Tlehini river, as a temporary boundary, as claims do not cross from one side of the river to the other. Neither has this temporary boundary any bearing on the main question

of the 1825 boundary line proper, which must be left to future discussion and arrangement. A *modus vivendi* has also been passed at Dyea Pass and White Pass, at the summit, for similar purposes.

So the matter rests at present, with the exception, however, that United States subjects continue to squat on locations for mining and fishing on the island Revilla Gigedo, and other islands in that locality, which seems to add to and intensify the complications and difficulties of a final settlement of the boundary dispute.

Although Hon. ex-Secretary of State Foster stated that "much of the difficulty of reaching an agreement on the correct boundary line grew out of the imperfect geographical knowledge of the period." An investigation of the circumstances shows, by reference to Captain Vancouver's maps and charts, that Mr. Foster's assertion cannot be supported. For instance, the description of Admiralty Island and the neighbouring continental shores points out most distinctly that along the precipices, inlets, and glaciers was no suitable place for a boundary line. The modern engineers and surveyors of the joint commission proved this clearly. They could not travel over those places, and were obliged to call in the aid of photography to arrive at the heights and distances of the region.

Sir Charles Bagot and the Home Secretary had these maps and charts and descriptions before them, and so outlined the line of demarcation between Russian and Great Britain, according to the treaty, at the distance of ten marine leagues from the ocean. To make their meaning clear, they indicated a landmark on the coast of the continent at the 56th degree of latitude, and gave Russia the whole of Prince of Wales Island.

As shown in Vancouver's *Atlas*, sheet 7, the waters of the Pacific ocean washed Prince of Wales Island from Cape Chacon, the southernmost portion of that island, along its eastern shores, following the northern shore, and turning southward at Point Baker, the name "Duke of Clarence Strait" is given along the island from Cape Chacon until the 56th degree of latitude is reached opposite Cape Decision. On the chart referred to, it is recorded that Captain Vancouver passed this point 22nd September 1793 and 24th August 1794.

But the treaty mentions that the boundary-line is required to reach latitude 56° at the coast of the continent. This is accomplished by passing along Clarence Strait and Ernest Sound to the coast. In Sir Charles Bagot's description (in Statement D) of the proposed line, to the Russian plenipotentiaries, which is recorded in a despatch to Mr. G. Canning, he says:—"It would appear that a line traced from the southern extremity of the straits named Duke of Clarence Sound, by the middle of those straits, to the middle of the straits that separate the islands of the Prince of Wales and the Duke of York and the islands situate to the north of the said islands; thence towards the east by the middle of the same strait to the continent, and thence prolonged in the same direction and manner already proposed by His Majesty's plenipotentiary to Mount Elias, or to the intersection of the 140th (since changed to 141st) degree of longitude, would form a line of demarcation

which would conciliate, perhaps in a satisfactory manner, the reciprocal interests, present and future, of both Empires in this part of the globe."

There is no mention of *Portland Canal* or going *east* in the foregoing description. Further, Mr. Canning in his instructions to Sir Charles, dated July 12, 1824, distinctly says: "His Majesty's Government have resolved to authorise your Excellency to consent to include the south points of Prince of Wales Island within the Russian frontiers, and to take, as a line of demarcation, a line drawn from the southernmost point of Prince of Wales Island, from SOUTH to NORTH, through Portland Channel, till it strikes the mainland in latitude 56." The route was named Portland Channel, presumably, as Clarence Strait, as we have seen, was left opposite Ernest Sound. It would be necessary therefore, at the point on the coast of the continent, that a new departure should be made to reach the intersection of the line with the 141st meridian, near Mount Elias.

It would appear from article IV. of the treaty, that Stratford Canning decided on the boundary from that point, being drawn ten marine leagues from the ocean. The easiest, fairest, and most convenient plan to do that would be to retrace the line of deviation back to that already run through Clarence Strait, named Portland Channel in the treaty, and continue that line along the eastern and northern shore of Prince of Wales Island, as already outlined in this review. Such an arrangement would obviate the attempt of forming a boundary line along the frontier of the continent, which would prove useless and impracticable. It would leave the frontier of British Columbia intact, and furnish the United States (instead of Russia) with ample facilities to carry on any industry along the large islands fringing the Pacific Ocean, and along the strip of continent extending about five degrees of longitude from Glacier or Taylor's Bay, beyond Icy Strait. It would give them any number of excellent harbours, and the control of valuable fisheries, and the timber on Prince of Wales Island, and the other ocean frontier islands north to the continent at Cross Sound. The arrangement was made between two friendly powers, and after the treaty was signed, was acknowledged to be satisfactory to each, and it should be so to the present day, although many United States sympathisers do not seem to interpret the treaty in that light.

Political feeling runs very high in the United States, and it may be that this boundary question is used by the United States press to influence parties *pro* or *con.* as the case may be. It has been discussed by their leading writers in the New York, Chicago, San Francisco, and other papers. The Seattle papers, being our nearest neighbours, have been the most lively. The Seattle Chamber of Commerce has discussed very forcibly what they call "the British claims." They, of course, advocate that the boundary line should run along *Portland Canal*. The Victoria *Colonist* in 1895, referring to a report of the Seattle Chamber of Commerce says: "From the language of the treaty it will be seen that the boundary commences at the most southernmost point of Prince of Wales Island, and then runs north until it reaches a point on the mainland at the 56th degree of north latitude. Now if any member of the

Seattle Chamber of Commerce looks at the map drawn by Vancouver, or any one else, and starting north from the most southern point of Prince of Wales Island, and keeping on in that direction until he reaches the 56th parallel of latitude, he will certainly trace along a channel, but not what is called Portland Canal, nor will he go near the Portland Canal, or the line which our good neighbours contend is the true boundary line. It is easy to give a new name to a channel, or to mistake one channel for another, but the points of the compass have always the same name, and are always in the same direction. Our contemporary and those who contend for the line now assumed to be the true one, must see that they start in the wrong direction. What would be thought of the surveyor who, when he was instructed to start from a point clearly defined *northwards*, ran his line *due east*, and afterwards had the impudence to contend that the line was right, and according to his instructions! Let our American friends 'stick to the point'—Point Chacon—and go north as the treaty enjoins from that point, and they will find they will not get near the line they are trying to make the people believe is the right one. Besides, Portland Canal is not even mentioned in the treaty. We trust we have been explicit enough in this article. We contend that our American friends start in the wrong direction: and we need not tell them that in beginning to run a line, it is of the utmost importance that the compass points exactly in the direction the description requires. The least variation, the one way or the other, vitiates the whole line, and the work must be done over again. In this Alaska line our friends are something like ninety degrees astray."

The House of Representatives of the State of Washington, in 1895, passed the following resolution, calculated to arouse anything but peaceful feelings amongst the people, relative to the fair settlement of the Alaskan boundary question. It read:—

"Whereas England, with her usual cupidity and avarice, and pursuant of her time-honoured custom of attempting, at all hazards, to get control of all newly-developed sources of wealth, in whatsoever country situated, and to appropriate to her own benefit the present and prospective commerce of the seas, whether rightfully or otherwise, has asserted claims to harbours, bays, and inlets, through which the greater portion of the commerce and trade of and with the territory of Alaska must be carried on, and which of right belongs to the United States.

"And whereas, the United States will be robbed and despoiled of the trade and commerce of a veritable empire, and suffer a diminution of the wealth with which nature has endowed said territory, if the claims and policy of Great Britain as aforesaid shall prevail:

"Therefore be it resolved by the House of Representatives of the State of Washington, the Senate concurring, that our members of Congress be requested, and our senators instructed to use all honourable means, that the rightful claims of the United States relative to said harbours, bays, and inlets be scrupulously maintained, and that an unequivocal policy on the part of the United States Government in relation thereto be fully carried out."

The editor of the *Colonist*, after quoting the resolutions, quietly

remarks:—"This should be preserved as a literary and legislative curiosity. It is amazing that men, supposed to be intelligent and sensible, should stultify themselves by voting for such a resolution as the above. Those who supported it, we suppose, thought it would tickle the ears of ignorant and anti-British electors, for it seems there is nothing too absurd for the average American legislator to do or say in order to increase his popularity. England, as far as we have heard, had done nothing towards rectifying the boundary-line between British Columbia and Alaska. The complaint in Canada is, that Great Britain on these boundary questions is a good deal too slack: that she has allowed wide-awake American diplomatists to take advantage of her. With respect to this matter of the Alaskan boundary she seems to be quite apathetic. The matter has been quietly discussed in the province lately, but all that has been said is that Great Britain should take measures to ascertain the true boundary-line, and not allow herself to lose territory through the carelessness or the ignorance of officials, either British or United States. The members of the legislature of the State of Washington may make themselves easy about the Alaskan boundary. The British want no more territory than is justly and legally theirs, and that, they believe, they will get without any trouble when the two Governments concerned go about settling the boundary question in earnest. If the coasts, harbours, bays, and inlets claimed by Great Britain do not belong to her, they will be readily surrendered when the day of settlement comes, let the State of Washington politicians RESOLUTE as they may. If they are not on the British side of the line, British subjects are quite content that they should remain in the possession of the United States. That is all there is about it."

The librarian of the province of British Columbia, in a paper from him in the *Canadian Magazine*, said:—"Every circumstance and reasonable assumption favoured the contention that the Portland Canal of Vancouver's chart, is not the Portland Channel meant in the treaty. A line through Portland Canal is wholly inconsistent with and contradictory of the general terms of the clause in question. Its acceptance in determining the boundary leads to an absurdity. Great Britain, therefore, is not bound to accept it as the boundary-line."

The *Canadian Gazette*, London, January 30, 1896, has the following editorial remarks:—"We publish this week a memorandum by Mr. Alexander Begg, who has given careful study to the records here in London, which seems to show that the meaning of the treaty of 1825 is clear in determining that the boundary-line, starting from the southernmost point of Prince of Wales Island, shall run northwards along the channel which we now know as Clarence Strait, but which the treaty describes as Portland Channel. To assume, as United States maps do, that the channel meant is Portland Canal, an inlet into the British mainland, is not only to contradict the plain meaning of the treaty, but to make nonsense of the explanatory statements of Sir Charles Bagot and Mr. Canning at the time of the negotiation of the treaty. We know no reason why Canada should hand over three million acres of land, and

an all-important strategic position to the United States, when the treaty clearly stipulates that she should retain them."

On the 5th of March following the *Canadian Gazette* returned to the subject, and said:—"General W. W. Duffield, superintendent of the United States Coast Geodetic Survey, replies to the statements made in *Canadian Gazette* of January 30th above quoted." The editor says:—"I propose to examine that reply of General Duffield, for, as I shall show, it only strengthens the case for an immediate inquiry into the circumstances whereby United States maps claim as United States territory three million acres of land in a position of high strategic importance on the Pacific coast, which the treaty of 1825 assigned, beyond doubt, to British sovereignty."

"General W. W. Duffield is stated to have said in his reply, that he attaches no importance to the despatch which asserts that the United States has no right, under the Anglo-Russian treaty of 1825, to three million acres of land opposite Prince of Wales Island. The General is said to discredit the statement for several reasons:—First, because, as he puts it, 'the language of the Anglo-Russian treaty [and that used by Russia in the transfer to the United States] are identical, as far as the boundaries are concerned; those treaties prescribe that the starting-point shall be the most southerly part of Prince of Wales Island, and that the line shall then proceed north through Portland Canal until it reaches the 56th parallel of latitude.'

"We are at one with the General as to the accuracy of the starting-point as mentioned, but we must differ from him when he says:—'the line shall then proceed through Portland Canal.' Here is where the difficulty comes in. Portland Canal is not mentioned in the treaty; neither does Portland Canal reach the 56th degree of latitude. After referring to the proposed boundary along the coast, north of latitude 56°, General Duffield continues:—'With this description in the treaties, I do not see how it is possible that there should be any differences between the two Governments.'

"Differences, however, do exist," the *Gazette* continues, "and General Duffield will require to show 'how it is possible' to reach the entrance to Portland Canal by going north, as required and described in the treaty, to the 56th degree of latitude, where the line of demarcation strikes the coast of the continent, before these differences can disappear. It may also be required that the United States representatives shall produce evidence to show why they have departed from the wording of the treaty, and substituted a new line south of 56°. It is a matter of fact that from the initial point of the line of demarcation, as mentioned in the treaty, the entrance to Portland Canal is slightly SOUTH of the said initial point, and about fifty miles to the east of it. It therefore follows, that to reach latitude 56°, the point of intersection mentioned in the treaty on the coast of the continent, the line must run from *south* to *north*, and NOT EAST, or from *west* to *east* as the United States maps assume.

"General Duffield further remarks: Moreover, Portland Canal is clearly designated on the charts by Captain Vancouver of the Royal

Navy, which were in existence when the treaty between Russia and England was entered into, so there can be no doubt as to where Portland Canal is.

"Perfectly true: there is not the slightest difficulty about the locality of Portland Canal, neither is there any doubt that the framers of the treaty did consult Vancouver's maps and charts, and understood them thoroughly. They indicated very closely where the meridional line of 132 west longitude, starting from Cape Chacon, should strike the coast of the continent at the 56th degree of latitude. This will be seen by examining the Provincial Map of British Columbia, the Admiralty Charts, or the United States Official Charts of that region, which show that the meridional line runs along the east coast of Prince of Wales Island, through Clarence Strait, and strikes the coast of the continent in Ernest Sound, making a slight deflection to the west around Cape Camaano, following the channel (called Portland Channel) as described by Sir Charles Bagot and the Right Hon. George Canning in 1824.

"The root of the matter is this," continues the *Gazette*:—"PORTLAND CANAL is an inlet into the mainland, so named by Captain Vancouver in 1793 or 1794; Portland Channel is a *coastal* water, so called by Canning in 1824-5. They are entirely distinct waters, in entirely different directions. The Portland Channel is named in the treaty as a prolongation of Clarence Strait and Ernest Sound—a natural boundary for British dominions. Portland Canal is a purely inland water running into British territory; and to assume that when the treaty spoke of Portland Channel it meant Portland Canal, is to run in the face of all the delimitations of the treaty, and of what an examination of the map shows to be the common sense of the question."

The strategic importance of this portion of British Columbia should be evident to every intelligent student of the map. The day will assuredly come, in the not very far distant future, when new lines of railway and telegraph will cross the Canadian half of the continent, and these lines, which under the new imperial policy, will make Canada the western highway of the empire, must play a large part in its consolidation. Can we afford, therefore, to allow valuable strategic and commercial points on the Pacific coast to pass into the hands of a foreign nation, when by treaty rights they are unquestionably British?

The necessity for such a protective arrangement was seen by the framers of the treaty; hence the stipulation to make the line of demarcation from 56, at *not more* than *ten marine leagues* from the ocean. This can easily be secured under international law, and what is the "ocean coast" can be ascertained without any expensive survey, and will furnish a just, practicable, convenient line, in accordance with the wording of the treaty, and prove an accommodation to the subjects of both nations who may require to use it, which could not be said of the boundary contended for by the United States, over glaciers and rock promontories.

Since the appointment of the Joint Commission in 1892, I have carefully noted their reported proceedings. The United States Commissioners have persistently contended for the boundary *via* Portland Canal from Cape Chacon; indeed some of them have gone farther west, to a

neighbouring island, and made its "southernmost point" (Cape Muzon), the initial of the boundary, as is shown on the United States official maps and charts. It is stated that on a large map of Canada, sent from Ottawa to the Paris Exhibition (1900), the Alaskan boundary is deliniated according to the United States contention, commencing at Cape Muzon, and thence due *east* to Portland Canal!

To arrive at as full an understanding as possible of the treaty of 1825 and the Portland Canal contention, I made a trip to London to consult the official archives there. The Colonial and Foreign Offices gave me every opportunity to obtain information; but I failed to discover anything in the records of negotiations or despatches touching the Alaskan boundary question, which gave the right of claim under the treaty to place the line of demarcation along or through Portland Canal. The direction and route indicated was by Clarence Strait and Ernest Sound to 56°. The difficulties alluded to by General Duffield have arisen from the United States starting the line from Cape Chacon, on the wrong point of the compass—90 degrees astray.

In the House of Commons Mr. Seton Karr (St. Helen's), in reference to the Alaskan boundary, asked the Secretary of State for the Colonies, "whether his attention had been called to the result of the investigations of Mr. Alexander Begg, historiographer of British Columbia, regarding the boundary line between Alaska and British Columbia, south of the 56th parallel of latitude, as detailed in the *Canadian Gazette* of April 16th; whether it was a fact as contended by the British Columbia Government that three million acres of land of high strategic and commercial importance, on the Pacific coast, opposite Prince of Wales Island, which was assigned to Great Britain by the Anglo-Russian Treaty of 1825, was now marked upon United States official maps and charts as United States territory; and whether seeing that this Alaskan boundary south of the 56th parallel was not reported upon by the recent Alaskan Boundary Commission, he would suggest to the Canadian Government that an early and independent investigation be made upon the subject."

The Right Hon. Mr. Chamberlain replied: "Mr. Begg has communicated to this department, from time to time, various memoranda, all of which has been duly transmitted to the Dominion Government. . . . When the question is ripe for diplomatic discussion, the points raised by Mr. Begg will no doubt receive due consideration for what they may be worth."

The *Canadian Gazette* of May 7, 1896, referring to Mr. Chamberlain's remarks in the House of Commons says: "We gather that as soon as the final reports of the Survey Commission have been received, this most important aspect of the question will claim attention. Meanwhile, it is enough to note Mr. Chamberlain's admission that the area which Mr. Begg maintains was assigned to Great Britain by the Anglo-Russian Treaty of 1825, is marked on all United States maps as United States territory. Mr. Chamberlain might have added, that it is so marked even on some Canadian maps, for a dependence on Washington chartography would seem, in this instance, to have misled even the alert officials at Ottawa."

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in January.

On the 9th January, Major A. St. H. Gibbons read a paper in Edinburgh on his Explorations in Marotseland, including his journeys up the whole course of the Zambesi, and by the great lakes of the Nile to Egypt. The Chair was taken by Colonel Cadell, V.C. Major Gibbons addressed a joint meeting of the Glasgow Branch with the Geographical and Ethnographical Section of the Glasgow Philosophical Society on the 11th, Mr. William Ewing occupying the Chair. He also addressed the Aberdeen Branch on the 10th, Sir John F. Clark, Bart. of Tillypronie, presiding.

Sir Thomas Holdich's addresses to the Society, announced for the 22nd in Edinburgh, the 24th in Glasgow, and the 25th in Aberdeen, were not delivered, in consequence of the illness and death of Her Majesty the Queen.

Lectures for February.

As at present arranged, Mr. J. E. S. Moore will address the Society in Edinburgh and in Glasgow, on the 7th and 8th February respectively, on "Some unknown Countries north of Tanganyika and the Mountains of the Moon." Mr. Alexander Hosie, British Consul at Neuchwang, is expected to read a paper before the Dundee and the Aberdeen branches later in the month.

Antarctic Exploration Fund.

A subscription of £10 towards the Antarctic Exploration Fund has been received from the Hon. John Abercromby.

GEOGRAPHICAL NOTES.

ASIA.

The Russian Province of Kuan-tung in Manchuria, which was organised by the Imperial ukase of 16-28 August 1899, is the subject of articles in *Petermann's Mitteilungen*, 1900, p. 197, and by M. J. Deniker in *La Géographie*, Nov. 1900, from which the following notes are gathered. The name, in its German form, is *Kwan-tung*, and in French, *Kouantoung*; *Kuan-tung* is the form which the word takes on the principles of transcription generally employed in Europe. The British Admiralty chart of 1860 renders it *Kuang-tung peninsula*. This transcription is said by Bretschneider to be inaccurate, because *Kuan-tung* is undoubtedly the Chinese designation, used alternatively with *Liao-tung*, for Manchuria; the expression means "East of the Palissade," and applies to the whole country which lies beyond that customs-barrier. As soon as the country had been officially annexed, after the Treaty of Pekin (March 15, 1898), the Russian Government sent MM. Borodovski and Kotvitch to investigate it both from the geographical and historical points of view; a detailed survey was taken, from which the Russian cartographer, General A. Bolchev, drew up a map to the scale of five versts to the inch, or 1 : 210,000; and M. Pokotilov, director of the

Russo-Chinese Bank at Pekin, with M. Tchechev, made a tour through the new province to study its commercial resources. The province occupies that part of the Liao-tung peninsula which lies south of a slightly irregular line drawn from the village Mon-kia-tung (west of Kiu-chang) on the gulf of Korea, almost directly west to the southern extremity of Port Adams. Within these limits, the province contains about 1987 sq. miles. The country is very hilly, but the highest summit, Mount Sampson, does not exceed 2010 feet; the coast is highly indented. The bay of Port Arthur lies at the extreme south of the peninsula; Ta-lien-wan bay, farther north, on the east coast, is wide and very deep, and has three indentations —Victoria bay on the west, and Junk bay and Hand bay on the north. The town of Ta-lien-wan stands on a promontory between the last two bays; and the Russian capital, *Dalny* ("the distant") has been established at the head of Victoria bay. Kuan-tung is in the same latitude as Sicily, but it suffers great extremes of climate; the thermometer rises in summer to 37·5° C., with moist south to south-west winds, and in winter descends as far as −19°, with dry north to north-east winds, sometimes with much snow, the mean annual temperature being 12·1° C. The population numbers about 300,000, including about 1000 Russians and 1000 other Europeans and Japanese. Agriculture is the chief occupation; the poor soil, in spite of the industry of Chinese cultivation, and the two harvests in the year, does not yield enough to supply the local demand, and wheat is imported from China, Japan, and America. Millet, maize, barley, and wheat are the principal crops. There is very little pasture, and therefore few cattle and horses: pigs and poultry are abundant. The forests have been destroyed, but the Chinese are planting oaks and pines on the hillsides, and poplars and willows along the streams. Gold has been found in several places, but has not been worked to any extent. The people of the coast are fishermen, and there is a small export trade in fish. There is a railway, over seven miles in length, from Port Arthur to Kiu-chau, with a branch to Dalny, and running to Po-lan-pu to join the railway of Eastern China at Kharbin. In March 1898, when the Russian occupation took place, Port Arthur was a miserable village, which had been half ruined by the Japanese. The Russians immediately drained it, enlarged the streets, and supplied good water by an aqueduct; there are now a church, schools, a branch of the Russo-Chinese bank, club, casino, racecourse, telephone-exchange, etc. There are 1000 Russians, 500 foreigners, and 7000 Chinese, exclusive of the floating coolies, who are more numerous than the settled population of the town. There is a local journal, *Novyi Krai*. The post comes in once in forty days. Ta-lien-wan has 2500 inhabitants; Pi-tsu-wo (Russian Bi-tsy-vo), the chief industrial centre, has a population of 12,000.

The Island of Taiwan (Formosa) received the name of Formosa from the Portuguese adventurers who discovered it in the first decade of the sixteenth century; it was first charted in the year 1550. The Chinese settled in its western portion during the seventeenth century, but were resisted, in the mountainous eastern portion, by Malayan races; so that the greater part of the island remained unknown until Taiwan passed under the Japanese flag. That enlightened people at once undertook a systematic exploration; an expedition was sent out from the University of Tokio in the years 1896-7; and many of its observations have been recorded by Dr. N. Yamasaki of Bonn University, who was one of the members of the expedition. From his graphic account of the island (*Petermann's Mitteilungen*, 1900, pp. 221 ff.) the following notes have been gathered.

The group includes Taiwan, the Hoko-to or Pescatores islands, together with a number of smaller islands, including Koto-sho (Botel-Tobago), Shokoto-sho (Little

Botel-Tobago), Kasho-to (Samasana), Sho-ryukyu-to (Lambay island), Kisan-to (Steep island), Agincourt, and other yet smaller rocky islands. The group is the most southerly of the three Japanese island groups which form the curved limits of three Asiatic seas from the Pacific.

The topography of the island is fairly regular and simple. The main water-parting runs from Bitokoku or Cape Pitau in the north-east, down the length of the island to the southern point Garampi, but does not always follow the crest of the mountain system which runs in the same direction. This range, which may be called from its highest summit the Niitaka range, and from its relation to two lower chains, the Central range, is not, as was formerly supposed, of volcanic origin. Mount Morrison, now called Niitaka-yama, rising from about the middle of the chain, is the highest Japanese summit (4145 m.). West of the central chain is a second, beginning at Bito-Kaku and running southward to the twenty-third parallel; this is called the Kali range; and the third, the Taito range, runs parallel to the others near the east coast from Pinan to Karenko, being separated from the main chain by the valley of the rivers Karenko, Shukoran, and Pinan. The chief range forms an arc, of which the concave side is turned towards the Pacific, whereas in Honshu, the chief island of Japan, the concave side is turned towards Asia. The east side of the chain is very steep, rising abruptly from the plain of Taito (East-Taiwan), or from the sea. There are many high summits which have for the most part not been ascended. Among these, towards the north-eastern extremity of the chain, are Taihaku-san (1052 m.), Taigen-san (1182 m.), Taiko-san (1431 m.), Jusampun-san (1432 m.). South-west of these is Setu-san or "Snow-mountain," which is marked on European maps as Mount Sylvia, and reaches a height of 3424 m. The eastern range is volcanic in nature; steep and rugged with many impressive peaks; the abrupt black rocks rising from the sea gave to one part of the coast the name of Black Rock bay. There is also a remarkable group of volcanic cones in the north of the island.

Most of the rivers are unnavigable, on account of their rapid descent. Only two of them, both of which are called Tamsui-kei ("Freshwater-stream"), one in the north of the island and the other in the south, are suitable for transport. The climate of Taiwan has been studied only since 1897, when five meteorological stations were established for the purpose of systematic synchronous observations at Taihoku, Taichu, Tainan, Koshun, and Hoko-to. These stations, in conjunction with others in Korea, Japan, and China, are expected to yield information of the highest value with regard to cyclones, which often arise in autumn in the vicinity of Taiwan, and proceed gradually northward to Japan. In the southern part of the island the climate is tropical and sub-tropical. February is the coldest, and July the warmest, month. The barometer stands high in December and January; low in June, July, and August. Since Taiwan lies in the region of the monsoon, the winds are very regular: north and east from September to April; southerly during the summer months. The terrible cyclone or typhoon, which arises two or three times a year in the China sea, often begins east of Taiwan, or in the neighbourhood of the Philippines, and moves northward along the east coast of Taiwan, with its centre about two degrees from the island. The atmosphere has a high degree of moisture, the monthly average being over 80 per cent.; in winter it is greater in the north than in the south, but this condition is reversed in summer. The rainfall is very high in the north in winter; the north-east monsoons, passing over the warm current, "Kurosiwo," bring much moisture which is precipitated on the high mountains. In summer, on the other hand, there are numerous tropical rain-storms over the south and west.

The island derives the name "Formosa" from the wealth and beauty of its

tropical vegetation. The bamboo grows everywhere on the plains, and is used for many purposes; even boats are built of bamboos laid side by side. The betelnut-palm (*Areca catechu L.*) is a common tree, cultivated, especially in the south, in gardens; its fruit and leaves are used by Chinese and Malays as a refreshing stimulant. *Ficus retusa L.* and *Ficus Wightiana Wall.* are common; *Pandanus odoratissima* frequents the plains and especially the littoral; the tree-fern (*cyathea spinulosa*), *Acacia Rhichii*, and the coral-tree (*Erythrina indica L.*) occur throughout the island. The ancient forests of the mountains are extraordinarily dense; the trees are covered with parasites and wound about with various creepers: in the lagoons of Takao there are mangrove woods. The most important cultivation is that of rice; the second is cane-sugar. The former is harvested twice in the year—even three times in the south. The sugar-cane is cut in November, and crushed in primitive mills. Next in importance is tea; the leaves are picked seven or eight times in the year, but the best quality comes from the second harvest of the spring. *Oolong* and *Pauchong* are the names under which Formosa tea appears on the market. The sweet potato (*Ipomaea batatas L.*) forms one of the chief foods of the inhabitants, and is cultivated in every part of the island. Bananas, pine-apples, various species of *Citrus* and other edible fruits are common, and the date-palm was found in one village. *Fatsia papyrifera Miq.*, from the snow-white pith of which the Chinese cut extremely thin shavings to form so-called rice paper, and the camphor-tree (*cinnamomum camphora Nees.*), which grows to a great height, are found in Taiwan more than elsewhere.

The zoological results of the expedition have not yet been published. But it is known, from the studies of Swinhoe, more than thirty years ago, that there are at least thirty-one kinds of mammals and about one hundred and fifty of birds. Black bears, foxes, bats, several rodents, deer, monkeys, wild pigs and armadillos occur. A buffalo (*Bos chinensis*) is the most important domestic animal. There are few horses and no sheep, but goats and pigs are common. The inhabitants of the coast live largely on fish.

The most important minerals are gold, coal, and sulphur; petroleum also has been found in several places.

The exports of Taiwan in 1898 were as follows:—Tea, 6,234,429 *yen*; sugar, 1,986,375; camphor and camphor oil, 964,624; rice, 2,168,179; boehmeria, 378,885; coal, 60,550 *yen*.

Railway in Siam.—The railway from Bangkok to Korat was formally opened by the King on December 21 last, and regular traffic will at once begin. The first of those included in the railway programme of the Siamese Government, the line was begun in 1891, and built at an enormous cost of life, owing to the pestilential character of the forest zone through which it passes up to the plateau.

AFRICA.

Journey in the Uganda Protectorate.—At the end of May of last year Sir Harry Johnson left Ntebbi, on Lake Victoria Nyanza, travelled through the Toru and Nkole districts, and in the month of July crossed the Semliki river and entered the Congo Free State, with the purpose of transacting business with the Free State officials. He was enabled during the journey to restore to their homes in the Congo forest a number of pygmies kidnapped for Paris Exhibition purposes by a German adventurer, and visited these little people in their homes. Photographs were taken of the dwarfs, their dances, implements, and dwellings, and anthropological measurements were also made by Mr. Doggett, the collector accompanying the Special Commissioner's expedition. Other dwarfs were subsequently examined

from the Mbogo district, the outlying portion of the Uganda Protectorate to the north-west of the Semliki river. The dwarfs, corresponding to the description of other travellers, were found to be of two kinds—black-skinned, with stiff, curling black hair about the body, and red or yellow-skinned, the hair on the head having a tendency to redness, and that on the body being of a yellowish grey colour. Their language appears to be a degenerate form of that used by the taller races in the vicinity, and is spoken in a curious sing-song.

Sir Harry Johnson was successful in making very interesting natural history collections in that part of the Congo forest stretching from the basis of the Ituri river to the vicinity of the Semliki. He ascertained the existence in these forests of a remarkable species of horse or zebra, of a uniform iron-grey colour on the upper part of the body, and white belly and legs striped with black or chestnut-coloured stripes. The head is said to be rather long and slender. From the portions of imperfect skins secured, it is concluded that they denote an animal of the horse tribe not hitherto known or described. The rumours of this creature which reached Stanley are described in one of the appendices of his book *In Darkest Africa*. Gorillas and chimpanzees also abound in the Congo forest, between the Ituri and the Aruwimi.

Sir Harry Johnson also spent three weeks in examining the upper part of Mount Ruwenzori, and with two of his companions reached an altitude of 14,800 feet on its highest peak, an apparently higher point than has yet been attained by any traveller. Beyond this they found a succession of sheer walls of rock. The largest glacier was ascended for 500 feet, and a series of photographs taken of the ice caverns and crevices. The lowest point of the largest glacier on Ruwenzori, on the eastern side of the mountains, is 13,200 feet in altitude. Snow was found as low as 13,000 feet, and permanent snow at 13,500 feet.

The Nile and Zambesi as Waterways.—Major St. Hill Gibbons read a paper at a meeting of the Royal Colonial Institute on the results of his recent exploration so far as the systems of the Nile and Zambesi were concerned, and emphasised the importance of utilising the vast tracts of country which they penetrated. Although in point of length the Zambesi ranked only fourth among the rivers of Africa, with its affluent, the Lungwebungu, its navigable reaches stretched three-fourths of its way across the continent, and many tributaries could be converted into practicable waterways at a much less expenditure than the cost of railway working would entail. Divided by nature into three sections, the Zambesi consisted of the lower river, extending from the sea to the Kebrabasa Rapids (400 miles); the middle river, from Kebrabasa to the Victoria Falls (900 miles); and the upper river, from the falls to the source (600 or 700 miles). The explorer was of opinion that the lower river, by means of embankments between the confluence of the Shiré and Tete, could be rendered navigable all the year round, and he and several companions ascended the middle river in a steam launch, and reached without difficulty the Middle Rapids, a point which terminates what for nine months in the year is a perfectly navigable piece of water. The British South Africa Company, as a result of this successful passage, was contemplating the opening up to trade of this remote region by means of stern-wheelers. With an available supply of good steamers, and a supply of good wood, and at least two coal-fields awaiting development, any expenditure would be amply repaid.

Discussing the value of the Nile as a waterway, Major Gibbons pointed out that the Uganda protectorate was second to no colony in Africa from an agricultural or climatic point of view, and that the tapping of the magnificent plateau lying to the east of Lake Albert was a matter of imperial importance.

The paying of carriers upon the Government scale cost Uganda per day what it cost any other part of Africa per week. The way to alter these conditions was to utilise the Nile for transporting supplies and merchandise to and from Ungoro and Uganda.

AMERICA.

The Census of 1900 in the United States.—The results which have now been published of the census taken on June 1 of last year permit a general view to be taken of the broad characteristics of the movement of population during the last decade. The absolute increase during that period, says the *Geographical Journal*, has been 13,141,064, an amount greater by half a million than that of the increase during the previous ten years, though when reduced to a percentage of the whole population it is less than has been recorded at any previous census during the nineteenth century. It works out at 20·8 per cent., as compared with 24·9 per cent. in 1890. In only one State—that of Nevada—is a decrease (of 7·5 per cent.) recorded, though the rate of increase in the remaining States and territories of course varies immensely. Leaving out of consideration the territory of Oklahomo (increase 544 per cent.), which occupies a special position, the increase per cent. varies from 0·9 in Nebraska to 105 in Arizona. Grouped according to geographical divisions, considerable variation is also noticeable, the increase in the western division (35 per cent.) being naturally much higher than in the centre and east. The lowest percentage (17·8) occurs in the north central division, though the South Atlantic with 17·9 is practically on the same level. In the North Atlantic division the increase rises to 20·9 and the south central to 24·8. Of cities with a population over 25,000 there are now 159, as compared with 129 in 1890. Nineteen now exceed 200,000, six exceed half a million, and three—New York, Chicago, and Philadelphia—have a total of over one million ; New York, in which are now included Brooklyn and Long Island City, containing 3,437,202 inhabitants. The largest increase per cent. (54·4) has occurred in Chicago, Cleveland coming next with 46, while New York and Buffalo are equal with 37·8. Of the total 20·8 per cent., about 14·8 per cent. seems to represent the natural increase, while 6 per cent. is due to immigration, which with a total of about 3,800,000 stands at a far lower figure than in the previous decade. Including Alaska and Hawaii, the grand total is now 76,210,820.

The Great Lakes and Hudson Bay Railway.—The Algoma Central Railway, destined to connect the Great Lakes with Hudson Bay, is now under construction, piercing its way through hundreds of miles of unbroken wilderness, with no towns or even villages to depend upon for support. The new railway started from Sault Ste. Marie about the middle of August last, and by the end of November twenty-five miles of road had been completed, and the railway was pushing forward at the rate of half a mile a day, a rate of progress from which the completion of the road is estimated at three years. Having its origin in the necessity of supplying the Sault mills with pulp wood from the far north, the new railroad will open up a region rich in minerals and timber. The minerals consist of iron, copper, and other valuable ores, together with a solid bed of gypsum eight miles in length ; while the timber supplies are equally valuable, extensive forests of trees, including birch, maple, hard elm, tamarack, spruce, balsam, poplar, and white pine hemming in the railway for hundreds of miles. The Ontario Government is greatly interested in the opening up of the region, and has given a large grant of land. The railway will give special attention to transport traffic, and at

the end of the first fifteen miles commenced to haul heavy consignments of timber, the traffic following closely upon construction. Reaching as it does to the very slope of the Arctic Ocean, opening up a region in which game is plentiful, and which abounds in rivers and lakes teeming with fish, and is noted for bracing climate and picturesque scenery, the railway is expected to attract a large tourist traffic.

The South American Congress at Madrid.—In a suggestive article contributed to *Questions Diplomatiques et Coloniales* (December 15, 1900), M. Pierre d'Espagnat considers the significance and the possible results of the movement towards a union of the Spanish-speaking States of South America with Spain. The conference, which was closed by the speech of M. Aguilhas del Campo, Minister of Foreign Affairs, was attended by delegates from Mexico, Guatemala, Honduras, Nicaragua, San Salvador, Costa Rica, Colombia, Venezuela, Ecuador, Peru, Bolivia, Uruguay, and the Argentine Republic. The impulse is literary and intellectual in origin, rather than political or commercial; and the great mass of the several peoples is probably unstirred by the enthusiasm of the delegates. The fact that Brazil, which is marked out by its rapid development as the necessary leader of any real federation against the pretensions of the United States, has taken no interest in this remarkable movement, makes it doubtful whether the latter can achieve success on the lines which it has taken. For Brazil, though intimately associated with the fortunes of Argentina, Bolivia, and Peru, could not join with them unless Portugal were to identify herself with the interests of Spain. If the proposed Latin confederation is to take real shape, it is more likely to express itself in Paris than in Madrid, and indeed it was suggested that the next Congress should take place in France. The speakers owed their apparent unanimity to a careful avoidance of those many unsettled questions which are debated and must still arise between the neighbour states; and Chile opposed a direct negative to the proposal of enforced arbitration as between the contracting parties. There was no evidence, in the opinion of M. d'Espagnat, of such a degree of understanding between the States as is necessary to a strong resistance to their common enemy in the northern continent. An even more insurmountable obstacle to genuine federation consists in the great variety of commercial interests. Since all the States follow a rigorously protectionist policy—and indeed can hardly do otherwise, because they live, for the most part, on import and export duties—and since Spain, by the treaty of Paris, cannot offer special commercial advantages to the Republics without opening the same door to the products of the United States, it is useless to expect a general customs union; yet the confederation, if it is to pass from discussion to reality, must surely reinforce the sentimental considerations and political interests by trade preferences. It is further pointed out that even in matters literary and scientific, in all the intellectual movements from which the congress arose, Latin America is more deeply interested in French than in Spanish ideas, and tends, more and more, to a distaste for the old, narrow, and fanatic spirit of the mother-country. M. d'Espagnat's conclusion is, that the movement is really a deeper one, more distant and difficult of attainment, yet significant of a larger destiny, than is apparent from the discussions of the Madrid Congress. He finds in it, or hopes from it, the germ of a revival of the Latin spirit and of the wider organisation of the Latin race.

The Boundary between British Guiana and Venezuela is to be determined by four commissioners, led by Mr. M. M'Turk, representing Britain, and eight Venezuelan commissioners, in accordance with the decision of the Paris Arbitration Court.

This work, which has recently been begun, is expected to occupy about a year. The commissioners start from Point Plaza, on the coast, and fix the boundary round the west and south of the British colony as far as the frontier of Dutch Guiana. Their determination of the boundary is without prejudice to the claims of Brazil in the south.

GENERAL.

Canadian Polar Expedition.—Captain Joseph E. Bernier, of Quebec, in connection with his proposed expedition to the North Pole, will lay two plans before the Canadian Government, based upon a long experience of Arctic seas, and said to be approved of by the best Arctic authorities. The first is that the expedition should start by way of Behring Straits, follow the coast of Siberia, and entering the ice between 165° and 170° of longitude E., push as far north as possible. He expects to reach the Pole and return in three or four years. His second plan, which has been submitted privately to the Quebec Geographical Society, is to start from Franz Josef Land with a large number of dogs and reindeer, and travel to the Pole during the summer by means of sleighs, subsisting on concentrated provisions and freshly killed reindeer. Travelling at an average of six miles per day, the journey to the Pole is estimated to take one hundred and fifty days, when he expects to have enough provisions to return towards Spitzbergen before winter sets in. He estimates that ten days of light will remain for the return journey, at the expiration of which he will winter on the ice. Captain Bernier will take with him from twelve to fourteen men, all scientists, and none merely sailors or labourers. He attaches great importance to the Marconi system of telegraphy for communicating with his base.

The Geological Survey.—Sir Archibald Geikie retires from the post of Director-General of the Geological Survey of the United Kingdom on March 1st.

NEW BOOKS.

The Illustrated Guide to Algiers. A Practical Handbook for Travellers. By Joseph C. Hyam. Profusely illustrated by full-page Engravings and numerous Illustrations in the Text, also Maps and Plans. Algiers: The Anglo-French Press Association, 1899. Pp. xii + 230.

The author of this work is editor of the Algerian *Advertiser*. He has spent some fifteen winters in Algiers, and in producing this handbook he has in view the needs of English-speaking visitors. It is divided into five parts, which deal with Algiers—general description, the town of Algiers, the environs of Algiers, the interior, and practical information. The chief characteristics are that it is emphatically practical and illustrated. While it merits high commendation in both these respects, it cannot be too highly commended for its illustrations. Many of these are from the author's own negatives, the others by well-known *photograveurs* of Algiers, and all have been specially taken for this work. Many of them are admirable both as works of art and as vivid and accurate aids to a knowledge of Algiers and Algerian life. Visitors to Algiers who have conned these beautiful illustrations will have the further delight of recognition on a personal visit. As a practical handbook it gives a great amount of information just of the kind that a visitor is most in need of and usually finds most difficult to obtain, such as "where to go shopping." While thus commending his work, we

have a word to the author; we beg leave to advise him to get the aid of an Arabic scholar to revise it for him, and to suggest that he give some account of the religious orders of Islam that are to be found in Algeria, and of the chief saints and marabouts with whom so many sacred buildings and places of pilgrimage are associated. We should also like to see some account of the literature dealing with North Africa. The maps are a railway map of Algeria and Tunisia, and a road map of the environs of Algiers.

The Welsh People: Chapters on their Origin, History, Laws, Language, Literature, and Characteristics. With two Maps. By JOHN RHYS, M.A., and DAVID BRYNMOR-JONES, LL.B. London: T. Fisher Unwin, 1900. Pp. 678 + xxvi.

It is said of an English statesman that he preferred a blue-book to a romance. It is a saying that may well be cited to introduce the notice of a work fully one half of which is based on the Report of the Royal Commission on Land in Wales and Monmouthshire. That Commission was appointed on March 27, 1893, and its Report was signed and delivered on August 26, 1896, forming Parly. Paper, 1896, C 8221, with Appendix to Report C 8242. The minutes of the evidence taken by the Commission are contained in five blue-books, which were published between 1894 and 1896. The present work consists of thirteen chapters which deal with the following topics:—the ethnology of Wales; the Pictish question; Roman Britain; early history of the Cymry; history of Wales from Cadwaladr to the Norman Conquest; the ancient laws and customs of Wales; history of Wales from 1066 to 1282; legal and constitutional history of Wales from 1282; history of land tenure in Wales; the religious movement; the educational movement; language and literature of Wales; rural Wales at the present day. There are four appendices which give a list of cantreps and cymwds; a discussion of pre-Aryan syntax in insular Celtic; a list of lordships in each county; and a note on the Welsh laws from the fifteenth Report of the Royal Commission on Historical MSS.

At the end of an introduction the authors give a brief description of the contents. It gives a good analysis of the book and shows the connecting thread of the several chapters. In the first, second, and third chapters they deal with the ethnology and origin of the Cymry, and in order to justify and explain their views, they discuss minutely some of the questions connected with the so-called "Picts," and the distribution of tribes in this island during the Roman occupation. Having shown that the Cymry emerge as a separate nation under the rule of Cunedda and his descendants when that occupation ceased, they pass on to state very briefly in the fourth chapter the Cymric history down to the death of Cadwaladr, when the kingdom in its more extensive sense came to an end. In the next (the fifth) chapter they treat of the history of Wales from that time to the Norman Conquest of England. Then they stop to describe the legal organisation and social condition of the Cymry in the tenth and the immediately succeeding centuries. In the seventh chapter they describe the way in which the greater part of Wales was gradually conquered by the Normans, and sketch the history of the last and greatest Cymric principality to its transference by conquest to Edward I. In the eighth, ninth, tenth, eleventh, and twelfth chapters they are occupied in showing how, for nearly all purposes of government, Wales has become organised in the same way as England; how the old Cymric tribal notions of landholding and administration (which became by natural and easy stages very like to those of the feudal system) gradually disappeared under the influence of Norman-English officials, and by degrees developed into the land tenure of to-day; how a religious movement commencing in the sixteenth century

culminated in a great revival in the eighteenth, and brought about the predominance of Nonconformity in the Welsh counties, the preservation and growth of Cymraeg, and an intellectual renaissance: and how this movement in its turn created a demand for schools and colleges, which has resulted in the formation of a system of Welsh public education as perfect as any in the United Kingdom. After that they pass on to give some information as to the language and literature of the Welsh; and finally, in the thirteenth chapter they describe the characteristic features of the most typical classes of the population of the Principality in our own day.

They have looked at the origin and history of the Cymry "not through the mists of Neo-Druidism or the bright but delusive atmosphere of mediæval romance, but in the clearer light of the evidence afforded by inscriptions, language, laws, and reasonably trustworthy chroniclers"; they have kept before their minds in the many problems to be solved the motto of the new-born University of Wales, "Goreu awen gwirionedd" ("Optima musa veritas"). On the historical side the judicial and comprehensive tone of the work is well displayed in the examination of the critical subject of Edward I.'s relations with Wales, a question hardly less vexed than that of Edward and Scotland. Of some special value, both for their own merit and owing to the inaccessibility of materials, are the chapters on the land laws and the legal and constitutional system of Wales. Here the authors are indebted to Mr. Frederic Seebohm, one of their fellow-Commissioners, for the greater part of chapter nine on the Welsh tribal system and the history of land tenure in Wales, which will appeal to ethnographic as well as economic students. Science and common-sense are characteristics of the entire work, and it is this combination of sound learning and sound judgment that inspires increasing confidence, and along with the lucid order in which the facts are marshalled makes the perusal of this learned work as delightful as many a historical romance. We have ourselves been much appealed to by the ethnological discussions, and in regard to the problem of the pre-Celtic or non-Aryan inhabitants of Britain we commend to notice the dissertation in the Appendix by Professor Morris Jones, which adduces the evidence of comparative philology in support of the anthropological evidence that they belonged to the North African race now represented by Berbers and other Hamites—the Mediterranean or Eurafrican race of Sergi. This sheds a flood of light on the problem of the Picts.

As the work is on the "Welsh people" there is one thing we desiderate—an account of the Cymry beyond the borders of Wales, not only in the chief towns of the United Kingdom but in the Colonies and the United States.

The maps are of Roman Britain and of Wales in cantreps and cymwds (made by William Owen—Dr. Owen Pughe—about the end of the eighteenth century). The tables give a chronological list of English and Welsh kings and princes down to 1066, and a genealogy of the House of Rhodri. The work is well indexed, the first giving names and other words; the second, topics and terms.

Glacières or Freezing Caverns. By E. S. Balch. Philadelphia: Allen, Lane, and Scott, 1900. 8vo. Pp. 337.

In this volume Mr. Balch gives an interesting account of the various kinds of subterranean ice formations, and more particularly of those which are met with in caves and other underground positions. He has himself visited and carefully described many notable glacières in Europe and North America, and he presents his readers besides with a descriptive catalogue of all those of which accounts have been published by others. An excellent list of authors who have dealt with

the subject concludes the volume. Mr. Balch reviews the various opinions which have been held as to the origin of glacières—some of these being peculiar enough. Thus certain authors have maintained that the formation of ice in caves is owing to the presence of salt in the rocks, while others have suggested that it may be due to the pressure on the water percolating down from the surface. Many of the explanations put forward would appear to have been based on the belief of the country folk, who almost always insist that the ice forms in summer and melts in winter. Most competent observers, however, believe that it is the other way about—that the ice is due to the cold of winter, while some think the formation is produced or helped by draughts and by evaporation and expansion of the air. Again, several writers have supported the view that the ice in caves is a relic of the glacial period, but that cannot be true, seeing that the ice in many caves, etc., disappears annually. According to our author, glacières are simply refrigerators, which preserve the snow and ice accumulated in them during the winter. The cold air of winter sinks into and permeates the cave, and by and by the water derived from melting snow, rain, or springs, becomes frozen. When once ice is formed it remains long after the ice outside the cave has disappeared. That these conclusions are correct is shown by the following facts. Glacières are confined to regions where, during part of the year at least, the temperature outside falls below freezing-point. Again, reliable observations show that the temperature of a glacière cave varies with that of the air outside, the range of course being much narrower. In winter the temperature is lowest, and as a rule below the freezing-point, while in summer it is highest, and generally above the freezing-point. Moreover, ice is never found far from the mouth of a cave, but always near enough for the cold air to get in. Evaporation, according to Mr. Balch, is connected mainly with the melting, not with the freezing, of the ice. Reference is made to the frozen soils and subsoils and so-called subterranean ice-sheets and buried "fossil glaciers" of high Arctic regions, and the author is apparently of opinion that all these are due to the long rigorous winters—the depth to which the ice extends being determined by the depth to which the winter cold can penetrate. Here, we think, he mixes up matters. That the frozen soils and subsoils of the tundras of Alaska and Siberia are formed by the direct freezing of the ground no one can doubt. But the thick ice-sheets described by Kotzebue, Von Toll, and others, are true relics of the glacial period. This is shown by the simple fact that they contain remains of the old extinct or no longer indigenous mammals of Pleistocene times, while the deposits underneath which they are usually buried have likewise yielded abundant relics of the same period. We can heartily commend Mr. Balch's work, which contains by far the best account of glacières which we have seen, and notwithstanding certain inelegancies of style, can be read with pleasure. It is well illustrated with a number of plates reproduced from photographs.

The Colombian and Venezuelan Republics. With Notes on other parts of Central and South America. By William L. Scruggs. London: Sampson Low, Marston, and Co., 1900. Pp. 350. *Price* 12*s.* 6*d. net.*

Mr. Scruggs is well qualified to write on the subject of this volume, having resided in the countries described from 1879 to 1899, having acted till 1893 as Envoy Extraordinary and Minister Plenipotentiary of the United States to the two republics, and having subsequently acted as special agent and legal adviser of the Venezuelan Government in the now happily ended dispute as to the true boundary between Venezuela and British Guiana. If any are now interested in that prolonged dis-

pute, they will find a detailed record of it and of the arbitration proceedings at Paris in 1899 in this volume. Unfortunately Mr. Scruggs does not print the full text of the Award then delivered, and whilst he somewhat triumphantly declares "The mouths of the Orinoco have been awarded to Venezuela, their true and rightful owner; and that, after all, was the great point of contention," he omits to give the qualifying paragraph of the Award, viz.: "In fixing the above delimitation, the arbitrators consider and decide that in times of peace the rivers Amakuru and Barima" (which fall into one of the mouths of, whilst the latter forms the best entrance to, the Orinoco) "shall be open to navigation by the merchant ships of all nations, subject to all just regulations, and to the payment of light or other like dues. Provided that the dues charged by the Republic of Venezuela and the Government of the colony of British Guiana in respect of the passage of vessels along the portions of such rivers respectively owned by them shall be charged at the same rates upon the vessels of Venezuela and Great Britain, such rates being no higher than those charged to any other nation." A map to illustrate the frontier dispute, and maps of Colombia and Venezuela and several illustrations are given.

The Travels of Sir John Mandeville. London: Macmillan and Co., Limited. New York: The Macmillan Company, 1900.

In these hard and matter-of-fact days at the end of the nineteenth century, when a traveller who ventures to publish an account of what he alleges he has seen and done in distant lands must be prepared to find his statements promptly challenged and scrutinised, and to produce irrefragable proof of the truth of his assertions and the accuracy of his observations, what room is there, it may be asked, for another edition of *The Travels of Sir John Mandeville*, which are now known to be for the most part the work of imagination? But we hope there are still among us some, and indeed many, old as well as young, who will find a very sincere pleasure in perusing the first book of travels written or translated in the English language. Indeed, the editor claims for it that it is "the first, or almost the first, attempt to bring secular subjects within the domain of English prose." As may be expected, the style is delightfully simple and clear; there are no learned disquisitions or ponderous digressions to pad the book and weary the reader. As a picture of the condition of Christian faith and legend about the fourteenth century it is extremely amusing and instructive; and now and then we come across passages which anticipate modern inventions in a curious way. Take, for example, these lines which show that the Egyptians had anticipated the modern egg-incubator. "And there is a common house in that city (Cairo) that is all full of small furnaces, and thither bring women of the town their eyren of hens, of geese, and of ducks, for to be put into these furnaces. And they that keep that house cover them with heat of horse dung, without hen, goose, or duck, or any other fowl. And at the end of three weeks or a month they come again and take their chickens, and nourish them and bring them forth, so that all the country is full of them. And so men go there both winter and summer." The work has been "reprinted rather as a source of literary pleasure than as a mediæval contribution to geography," and as such it will be heartily enjoyed by all who can enjoy a story of fiction as well as of fact. To the travels of Mandeville have been added the narratives of two friars, "John de Plano Carpini, sent as an embassy to the great Chan by Pope Innocent IV. in 1246, and William de Rubruquis, who travelled in the interests of Louis IX. of France in 1253, and the voyage of Friar Beatus Ordericus to Asia Minor, Armenia, Chaldæa, Persia, India, China, and other

remote parts, Odoric being a Franciscan of Pordenone in Northern Italy, who dictated an account of his travels in 1330."

South Africa: its History, Heroes, and Wars. By Professor W. Douglas Mackenzie, assisted by Alfred Stead. London: Horace Marshall and Son. (English Edition.) Pp. 675. With Illustrations.

Professor Mackenzie tells us in his preface of his "earnest desire to tell to thousands of Americans a complicated story which was being most seriously misrepresented, and whose misrepresentation threatened to interfere with the growth of that frank avowal of friendship for Great Britain which during the last two years has been so rapidly spreadingthroughout the nation." He gives a prominent place, as is natural, to the story of the Jameson Raid, with the organising of which he emphatically maintains that Mr. Chamberlain was associated. It does not seem to have occurred to Professor Mackenzie that such conspiracy on the part of a responsible Minister of the Crown is scarcely likely to win for us American sympathy. Apart, however, from this point, we cannot describe the book as a success. Its design is evidently to tell all about South Africa. It sketches the past history of the country, describes its leading towns and men, tells of diamonds and gold, and gives an account of the causes of the war and of its progress so far as Lord Roberts' occupation of Pretoria. It is unfortunate that, with such a field to cover, the style of writing is so diffuse. In several instances statements are inexact, and it is not clear that any of the information is first-hand. On the whole, Professor Mackenzie would have been wise in restricting his labours to the life of his father, the Rev. John Mackenzie, of Bechuanaland, who plays an honourable though minor part in the story.

Russia in Asia: A Record and a Study, 1558-1899. By Alexis Krausse. Second edition, 1900. London: Grant Richards. New York: Henry Holt and Co., 1900. Pp. xxx + 411. *Price* 10*s. net.*

Those who had acquainted themselves with the first edition of Mr. Krausse's masterly book, *Russia in Asia*, will not be surprised to learn that a second has been called for within a comparatively short period. His work constitutes the only complete account of Russian activity throughout Asia that is at present before the reading public, and no one who is at all interested in the question of our future eastern policy can afford to overlook this study. Mr. Krausse brings out with almost painful lucidity the fact that all along the line from Constantinople to Port Arthur, it is really Russia and this country that are engaged in silent conflict, and that hitherto all the advantage has lain with the Slav. He also anticipates the time when the conflict must become open, and shows us to be either sadly ill-informed or indifferent to the real state of matters, and, in consequence, for the most part unprepared.

Chapters are devoted to the various stages in the Russian advance on Asia, and bulky appendices contain the text of her various opportunist treaties. A prefatory chapter is added to this edition which brings the book up to date. In it, however, we find a statement with regard to British influence in the Persian capital (p. xxii.) which hardly tallies with others on pp. 17 and 120. We also find in the same chapter (p. xi.) the peculiar variant, Hinka for Khanka. A portion of the account of the Trans-Siberian railway has not been revised in accordance with the latest plans. Thus it is now generally understood that the Trans-Manchurian branch will leave the Siberian trunk at Kaidalova, some fifty miles to the east of Chita, and not from Nertchinsk as stated on p. 210. Further,

the railway had to be carried and has been carried beyond that town to Stretyensk before effective river communication could be instituted with Khabarovka. It is certainly true that in 1897 "trains were run as far as Omsk," but as a matter of fact the line was open for regular traffic as far as Tomsk the previous year, and the present writer travelled by special permit as far as Krasnoyarsk. We also have become acquainted in these pages for the first time with the statement that there was initially a proposal to carry the railway round the north end of Lake Baikal. A glance at the map will show that there is either some error here or that Mr. Krausse has put on record a scheme that most Russians have recognised to have done little credit to its deviser, and consequently have omitted to chronicle. Khabaroff (p. 26) and Chabaroff (p. 123) is doubtless a printer's error, as is also Tchinovik (p. 19). Apart from these minor blemishes, we have a volume which is certain to remain a standard for many years to come.

Scrambles in the Eastern Graians, 1878-1897. By GEORGE YELD. London: T. Fisher Unwin. Pp. 275. With Illustrations, Map, and Index.

In Piedmont, a little south of Aosta, lies a climbers' district, which Mr. Yeld has annexed by right of conquest. In its small compass are some dozen peaks or cols of 12,000 feet or over, and two dozen others of 11,000 feet, whose ascents he describes in this book, many of them first ascents either actually or by his routes. Some peaks still remain unconquered, but his enthusiasm has spared few, and, to judge from the attractive photographs which adorn his pages, a climber will find here a rare field of interest. Already the rude simplicity of the eighties is giving place to comfortable hotels, and there may be many to whom the author's perversion may apply—

> "Though Zermatt's glories did his youth engage,
> He sought the Graians in his riper age."

But we must enter a protest on behalf of one mountain. The description of an ascent on pages 45 to 48 leaves us in doubt as to which is the peak referred to, and it is only from the index that we learn it was the Grivola. Again, nowhere have we found a note of the height of this peak. But this injustice can be easily remedied. The author's enthusiasm for his hobby, his delight in mountain scenery and flowers, make him admirable company, and we do not doubt that his book will draw others to his happy hunting-ground.

In the Ice World of the Himálaya: Among the Peaks and Passes of Ladakh, Nubra, Suru, and Baltistan. By FANNY BULLOCK WORKMAN, M.R.A.S., F.R.S.G.S., and WILLIAM HUNTER WORKMAN, M.A., M.D., F.R.G.S. With 3 Maps and 67 Illustrations. London: T. Fisher Unwin, Paternoster Square, 1900. Pp. viii + 204. *Price* 16*s.*

This is an account of the personal experiences of the joint authors on various mountaineering excursions among the Himalayas. The scope of these excursions may be most easily defined by quoting a sentence or two from the introduction. "During . . . 1898 we made an expedition from Srinagar, to which point we cycled, into the mountains of Ladakh, Nubra, and Suru, and in the autumn, from Darjeeling into Sikkim. In July 1899, starting again from Srinagar, we crossed the Deosai plains into Baltistan. From Skardu we went to the Shigar valley, over the Skoro La to Askole, and up the Biafo glacier to the Hispar pass. Returning over Askole, we made the ascent of two hitherto untrodden peaks of the Skoro La circle, and of Koser Gunge, from the Shigar valley. We then retraced our steps to

Srinagar, whence we visited the Lidar valley, following it up to its termination in the glaciers of Kolohoi, upon which we made a reconnaissance to the base, 15,000 feet, of the highest peak, which, owing to the lateness of the season, was covered with fresh snow to such a depth, that attempting to ascend it was out of the question. . . . For the last season's expedition, we were enabled to secure the services of the noted guide, Mattia Zurbriggen." Of the three expeditions undertaken by the writers, the second, that in Sikkim, proved quite abortive. Four causes are mentioned as combining to render exploration in this quarter difficult—(1) the weather, (2) expense, (3) "the Government authorities are reputed to be disinclined to grant the necessary passes" for exploring in the neighbourhood of the forbidden land of Nepal and Thibet, and (4) "there is, so far as we could learn, no governmental regulations of coolie service, as in other Himalayan districts, to compel coolies to carry out their contracts. . . ." As to which of these four causes was most powerful in frustrating the proposed journey, the reader is left in little doubt; the Political Officer at Darjeeling is the individual whose action or inaction made redress impossible after a large expenditure had been incurred in fitting out an expedition which returned after reaching a distance of twenty-five miles from its base. It would perhaps be interesting to hear the said Political Officer's account of the incidents described. The two expeditions, or series of expeditions, in Kashmir, in 1898 and in 1899, occupy the great bulk of the volume, and form highly interesting reading for the most part. The point of view throughout is that of the mountaineer rather than that of the explorer. It is the personal experience rather than the scientific fact which is generally brought forward. The idiosyncrasies of a native cook or coolie may assume for the time being much greater importance for the mountaineer than the geology of the district, and the loss of a topie in a gale may affect personal comfort more than all the other climatic influences combined. In such cases, the book records the facts in the proportion of their present impressiveness. But to say this is only to indicate that the volume is not a geographical treatise, but a graphic record of personal experiences. And taking them all in all, the experiences are worth recording and are well recorded. They include a vast amount of hard and persevering work,—mountaineering carried on, as is pointed out in the introduction, under circumstances vastly more trying than in such regions as the Alps, where civilisation lies at the door. In the course of the last tour, Mrs. Bullock Workman established three consecutive world mountaineering records for women, viz., 18,600, 19,450, and 21,000 feet. This alone, even under the guidance of Zurbriggen, is something for a mountaineer to boast of. An interesting chapter is given by Dr. Workman on his experience of the physiological effect of climbing at high altitudes, and of the use of various foods and drinks by mountaineers A glossary is added, giving the meanings of the native words employed, as well as some of the mountaineering terms, but the principle of selection in the case of the latter is not evident; it is not clear, for example, why such a word as *massif* should require explanation, while others like *arête* and *sérac* are passed over. The system of punctuation adopted is peculiar, and in some cases has a puzzling effect; for instance, "We have never yet had a servant, who has done for us, what he or she was declared in *chits* to have done for other employers. It may be, that servants have suddenly become incompetent while in our employ, or, it may be, that, in the enthusiasm for *chit* writing, their former employers have overstated their capacity."

The route maps given at the end are extremely clear and good. The numerous illustrations, reproductions from photographs for the most part, and including excellent portraits of the writers, give a distinctly increased value to the book. They are well selected and well produced, and represent many interesting scenes

and events connected with this chronicle of adventure, "In the Ice-world of Himálaya."

La Hollande. Par MM. François Bernard, C. H. B. Boot Louis Bresson, etc. Paris: Librairie Laroupe.

In this account of Holland we have no less than sixteen collaborateurs, and it goes without saying that there is much diversity of style and merit in the treatment of the various subjects which have been assigned to them. On the whole it appears to us that the monographs on the history and art of Holland have been most effectively treated and are the most interesting. The volume, however, contains a fairly full and detailed description of the Holland of to-day—its appearance, population, constitution, army, navy, etc., and there is an useful appendix giving a number of authorities, which a reader desirous of going into the subject more thoroughly may consult with advantage, but we observe that, with the exception of two hardly known if not obsolete petty works, no English book is mentioned as calculated to be of use to the student of Holland and its colonies. The book is profusely illustrated, but the maps are very indifferent.

Lieutentant-Colonel John Haughton, Commandant of the 36th Sikhs, a Hero of Tirah. A Memoir by Major A. C. Yate, 2nd (Duke of Connaught's Own) Baluch Battalion, F.R.G.S. London: John Murray, 1900. Pp. xvi + 238. With 3 Maps and numerous Illustrations.

The first half of the book deals with its hero's family history, early life, and service before the opening of the Tirah campaign in 1897; it includes an account of the military exploits of his father during the first Afghan War. The interest of the work centres in its second half, which relates the part played by Colonel Haughton and his regiment in the war, which, unfortunately, deprived the country of his further services. He is shown to have been a brave and capable soldier, who commanded the confidence and respect of all ranks, and he greatly distinguished himself during the operations which afforded him his first and last experience of actual warfare.

The story of his life is one that may be read with profit by all young officers and by lads who look forward to a military career. If they be thereby induced to follow the bright example of John Haughton, the army will be the gainer. In the concluding chapter the author gives his own views on the lessons of the war and the training of military officers. The illustrations are of high quality.

Hazell's Annual for 1901. Edited by W. Palmer, B.A. London: Hazell, Watson, and Viney, Ltd., 1901.

The Guide to South Africa. Edited annually by A. Samler Brown and G. Gordon Brown. 1900-1901 edition. London: Sampson Low, Marston, and Co., Ltd.; Cape Town: J. C. Juta and Co. Pp. 416. *Price* 2*s.* 6*d.*

The above are new issues of excellent and well-known handbooks; they have as usual been carefully revised. Hazell's *Annual* has reached its sixteenth yearly issue, and now comprises a volume of 696 pages of indispensable reference matter. In Brown's *Guide to South Africa* the information, which is very complete, is written for tourists, sportsmen, invalids, and settlers. The numerous maps will be found of great service.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

A BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.

By Sir John Murray, K.C.B., D.Sc., F.R.S., and the late Fred. P. Pullar, F.R.G.S., F.R.S.E.

Part II. The remaining Lochs of the Forth Basin.

Introduction.

Part I. of this work, dealing with the lochs of the Trossachs and Callander district, viz., Lochs Katrine, Arklet, Achray, Vennachar, Drunkie, Lubnaig, Voil, and Doine, was published in this magazine in April 1900.[1] This second part treats of the remaining lochs of the drainage basin of the Forth, viz., Loch Chon, with Lochan Dubh, Loch Ard, and Lake of Menteith in Perthshire, and Loch Leven in Kinross-shire. The methods and apparatus used were the same as those described in Part I., all the soundings having been taken from rowing-boats with the F. P. Pullar sounding-machine.

Maps and Illustrations.

The general map of the district published in Part I. includes the lochs now treated of, except Loch Leven. The four maps illustrating this part show the depths in each of the lochs under consideration, on the scale of three inches to the mile (1 : 21,120), most of the soundings taken during the survey being given in feet. The intervals between the contour-lines of depth are indicated by different shades of blue, and the intervals between the contour-lines of height of the neighbouring country by shades of brown.

Plate I. shows Loch Chon with Lochan Dubh, the contour-lines of depth being drawn in at 25, 50, and 75 feet.

[1] Vol. xvi. pp. 193-235, with seven coloured maps.

Plate II. shows Loch Ard, the contour-lines of depth being drawn in at 25, 50, 75, and 100 feet.

Plate III. shows Lake of Menteith, the contour-lines of depth being drawn in at 10, 25, 50, and 75 feet.

Plate IV. shows Loch Leven, the contour-lines of depth being drawn in at 10, 20, 50, 70, and 80 feet.

In addition to the maps there are four woodcuts in the text, illustrating the character of the scenery around the lochs.

Depths of the Lochs.

Loch Chon.—There are two lochs in Perthshire bearing this name, the one a little loch in the parish of Blair Athole. The Loch Chon now

(Photo by G. W. Wilson.

Fig. 1.—Loch Chon.

under consideration lies to the south of Loch Katrine, and trends in a north-west and south-east direction. It lies at a height of 296 feet above sea-level, and the river into which it flows expands, a little distance to the south-east, into the small loch, Lochan Dubh or Loch Dhu, the surface of which is 10 feet lower. Loch Chon is over $1\frac{2}{3}$ miles in length, and the greatest width is about one-third of a mile. The mean breadth, obtained by dividing the area of the loch by its length, is a quarter of a mile, being 15 per cent. of the length. Its waters cover an area of about 277 acres, or less than half a square mile, and it drains an area about $14\frac{1}{2}$ times greater, or nearly 4000 acres (nearly $6\frac{1}{4}$ square miles). The number of soundings taken in Loch Chon was 157, the greatest depth observed being 75 feet. The mass of water contained in the loch is estimated at 358,000,000 cubic feet, and the mean depth

at over 29 feet, or 39 per cent. of the maximum depth. The length of the loch is 120 times the maximum depth, and 305 times the mean depth.

Loch Chon is irregular in outline, and the contour-lines are also irregular. The deepest part of the loch (*i.e.* exceeding 50 feet) forms a long, narrow depression, situated approximately in the centre of the loch but closer to the western than to the eastern shore, about seven-twelfths of a mile in length with a maximum width of over one-sixth of a mile. The maximum depth, 75 feet, was found comparatively very close to the western shore, being in fact only about 130 yards distant; this gives a slope of almost 1 in 5, and a similar steep slope is indicated by the near approach to the shore of the contour-lines for a considerable distance along the western side of the loch. The slope from the eastern shore is, generally speaking, more gradual. The 25-feet depression is divided into two portions by the rising of the floor of the loch about a quarter of a mile from the southern end. The maximum depth in the smaller southern depression is 49 feet. The larger 25-feet depression, separated from the smaller one by an interval of about one-eighth of a mile, is over $1\frac{1}{4}$ miles in length, approaching close to the north-western end of the loch, with a maximum breadth of three-eighths of a mile. This larger depression is very irregular in outline, occupying nearly the full width of the loch towards the centre, while a short distance farther south there is a narrow constriction in the vicinity of the Heron Islands.

The area of the bottom between the shore line and the 25-feet contour is about 119 acres, or 43 per cent. of the total area of the loch; that between the 25- and 50-feet contours is about 127 acres, or 46 per cent., and that deeper than 50 feet is about 32 acres, or 11 per cent.

Lochan Dubh.—This little basin is one-fifth of a mile in length, and less than one-sixth of a mile in maximum width. Its waters cover an area of about $11\frac{1}{2}$ acres, and it drains an area eighteen times greater, or about 205 acres. The mean breadth is less than one-tenth of a mile, or 45 per cent. of the length. Twenty-five soundings were taken in Lochan Dubh, the maximum depth observed being 41 feet. The cubic mass of water is estimated at 586,000 cubic feet, and the mean depth at nearly 21 feet, or 50 per cent. of the maximum depth. The length of the loch is 28 times the maximum depth, and 56 times the mean depth.

Lochan Dubh is very simple in construction, shoaling on all sides down to the deepest part. As in Loch Chon the slope seems to be much steeper off the western than the eastern shore, a cast of 35 feet having been taken comparatively very close to the west side. The water shallows where the loch narrows a little above the outlet, a depth of $3\frac{1}{2}$ feet being found where the bottom is covered with reeds. The area of the bottom between the shore and the 25-feet contour-line is about 7 acres, or 60 per cent. of the area of the loch, and that deeper than 25 feet is nearly 5 acres, or 40 per cent.

Loch Ard.—Loch Ard receives the outflow from Lochan Dubh and Loch Chon; it trends in an east and west direction, sending out one prolongation to the south and another to the east. Its level is 105 feet above the sea. It is over three miles in extreme length, including the eastern prolongation, but the body of what may be called the loch proper is about $2\frac{1}{3}$ miles in length: from the head of the loch to Helen's Rock.

The greatest width, measured from the extremity of the southern prolongation to the northern shore of the loch, is over one mile, the mean breadth being two-fifths of a mile. Its waters cover an area of over 600 acres (nearly one square mile), and it drains an area of more than ten times greater, or about 6250 acres (9¾ square miles). The number of soundings taken in Loch Ard was 308, the maximum depth being 107 feet. Thus the deepest part of Loch Ard dips two feet below sea-level. The cubic mass of water contained in the loch is estimated at 1,150,000,000 cubic feet, and the mean depth at nearly 44 feet, or 41 per cent. of the maximum depth. The length of the loch is 113 times the maximum depth, and 277 times the mean depth.

Loch Ard proper forms a comparatively simple basin, shoaling from

(Photo by J. Valentine.)

FIG. 2.—Loch Ard, with Ben Lomond in the distance.

the shores down to the deepest part. The 100-feet depression occupies a central position, and is about three-quarters of a mile in length. The 75-feet depression is over 1¼ miles in length, while the principal 50-feet depression, over 1½ miles in length, is separated by a very short interval from a small detached area in the north-western part of the loch at Kinlochard, in which the depth exceeds 50 feet. The 25-feet contour-line is very irregular, and there are four isolated patches in which the depth exceeds 25 feet: the largest one in the southern prolongation at Couligartan has a maximum depth of 39 feet; a second small area occurs between the southern prolongation and the island of Eilean Gorm, in which the maximum depth is 35 feet; the other two areas are situated in the eastern prolongation of the loch, the maximum depth in the eastmost depression near the outlet of the loch being 33 feet, and in the other 39 feet. The soundings taken between Duke Murdoch's Castle and Briedach show that the bottom is very irregular: the first

sounding gave a depth of 17 feet, followed by 44 feet, then 38 feet, then 23 feet, then 31 feet, the bottom rising on approaching the elevation on which Briedach and a beacon are situated.

The area of the bottom between the shore and the 25-feet contour-line is about 240 acres, or 40 per cent. of the area of the loch; that between the 25- and 50-feet contours is about 154 acres, or 25 per cent.; that between the 50- and 75-feet contours is nearly 64 acres, or 11 per cent.; that between the 75- and 100-feet contour-lines is about 78 acres, or 13 per cent.; and that deeper than 100 feet is nearly 65 acres, or 11 per cent.

Lake of Menteith.—The Lake of Menteith resembles Loch Leven somewhat in outline, and in being relatively a very shallow basin. It is also historically related with Loch Leven, since Queen Mary at one time

(*Photo by G. W. Wilson.*)

FIG. 3.—Lake of Menteith.

lived within their precincts; the ruins of the Priory on Inchmahome, in which she resided before her removal to France, are of great architectural beauty and antiquarian interest. Its surface is only 55 feet above the sea. Its maximum length is over $1\frac{1}{2}$ miles, and the maximum width over one-mile, the mean width being five-eighths of a mile. Its waters cover an area of 652 acres (over one square mile), and it drains an area $6\frac{1}{4}$ times greater, or over 4000 acres (nearly $6\frac{1}{2}$ square miles). The number of soundings taken in the Lake of Menteith was 375, the maximum depth being 77 feet. A small portion of the bottom thus falls below sea-level, as indicated on Plate III. The cubic mass of water contained in the loch is estimated at 562,000,000 cubic feet, and the mean depth at $19\frac{3}{4}$ feet, or 26 per cent. of the maximum depth. The length of the loch is 110 times the maximum depth, and 427 times the mean depth.

The bottom of the Lake of Menteith is apparently very irregular. The 10-feet line follows approximately the outline of the loch, except that it is considerably removed from the south and south-east shores, where the

land is bordered by reeds; it also surrounds the islands of Inchmahome, on which the Priory is situated, and Inch Talla, on which the castle is situated, Dog Isle, and a submerged crannog covered by four feet of water in the north-eastern angle of the loch at Port of Menteith. The area of the bottom covered by more than 25 feet of water is cut up into three portions. The eastmost of these 25-feet depressions has a maximum depth of 48 feet; the central 25-feet depression is almost triangular in outline, with a maximum depth of 49 feet. The westmost 25-feet depression is the largest and the deepest: it is almost divided into two halves by a narrow constriction between Inch Talla and Stable Point, the deepest water observed in the southern half being 49 feet, while the northern half contains the deepest water found in the loch. Here the bottom falls below the depth of 50 feet over an area of nearly 32 acres, the 50-feet depression being about a third of a mile in length and over a sixth of a mile in maximum width. It encloses a small patch in which depths of 75, 76, and 77 feet were observed—the maximum depth of the lake—situated comparatively close to the northern shore at Coilledon.

The area of the bottom between the shore and the 10-feet line is about 22 acres, or 34 per cent. of the whole area of the loch; that between the 10- and 25-feet contours is about 255 acres, or 39 per cent.; that between the 25- and 50-feet contours is about 142 acres, or 22 per cent.: and that over 50 feet nearly 32 acres, or 5 per cent.

Loch Leven.—Loch Leven has long been famous for its trout. In the old *Statistical Account of Scotland*[1] we read:—"The high flavour and bright red colour of the trout seem evidently to arise from the food which Nature has provided for them in the loch. What appears to contribute most to the redness and rich taste of the Loch Leven trout is the vast quantity of a small shellfish, red in its colour, which abounds all over the bottom of the loch, especially among the aquatic weeds. The trout when caught have often their stomachs full of them."

About the year 1770 the trout brought about a halfpenny each, large and small, and perch a halfpenny per dozen. Some years later the price was doubled, and towards the end of the century the trout were sold at 4d. per lb., pike 2d. per lb., and perch 2d. per dozen. In 1845 two boats and four boatmen were employed during part of the fishing season, while in 1891 there were twenty-two boats on the loch for the use of anglers. Extensive operations for the draining of the loch were completed about the year 1845 at a cost of £40,000, by which the loch was lowered 4½ feet, and the area reduced by about 1400 acres: some people maintain that the quality of the trout has been injuriously affected by the draining. Prior to 1856 rod fishing was disappointing, but about that time, from some cause that does not appear to have been satisfactorily explained, the fish rose more freely to the bait, angling became more encouraging, and Loch Leven became a resort for anglers from all parts of the country. Some years ago the fishing was taken over by the Loch Leven Angling Association, Limited, who pay a rental of £1000 per annum. The statistics regarding the trout caught by rod in the loch, and their weight, show great fluctuations from season to season. In 1872 over 17,000 were taken, the average weight being nearly 1 lb.: in 1873

[1] Vol. vii. pp. 166, 168, 1793.

the take fell to 13,400, in 1874 to 6400, in 1875 to 5000, and in 1876 even less. In 1877 the take rose again to 6000, in 1878 to 13,000, and in 1879 to 21,000, but the average weight seems to have been less. The best year recorded during the last quarter of a century was in 1888, when 23,516 trout were taken weighing 21,074 lbs. In 1893, 1898, 1899, and 1900 the takes again exceeded 20,000, but the weight never equalled the 21,000 lbs. of 1888, the nearest approach being in 1893, when 23,100 trout weighing 19,500 lbs. were caught. Last year (1900) the trout taken by the rod numbered 23,811 weighing 15,584 lbs., an average of 0·654 lb.

Perch are also abundant, and pike are not uncommon. Formerly charr were frequently taken, but they appear to have become scarce in

(Photo by J. Valentine.)

Fig. 4.—Loch Leven and Castle.

recent years. The American weed (*Elodea canadensis*) appears to have become firmly established in certain parts of the loch, and is causing a great deal of trouble, all the means hitherto tried for the purpose of destroying it being only of temporary benefit.

On St. Serf's Island (which is about 80 acres in extent) are the remains of a Priory dedicated to St. Serf, said to have been founded by a Pictish king, and given to the Culdees. The castle (on Castle Island, which has an area of about 5 acres) is said to have been founded by Congal, son of Dongart, king of the Picts. It is famous in history as the prison in which the unfortunate Queen Mary was incarcerated for eleven months, and from which she effected her romantic escape.

Considering the area covered by the waters of Loch Leven, it is an extremely shallow loch, its mean depth being less than that of any other loch hitherto examined by us. When measured by the Ordnance Survey officers in August 1893, its surface was found to be 349·6 feet above the level of the sea. In form it is somewhat pear-shaped, the greatest length

being $3\frac{3}{8}$ miles from south-east to north-west, and the greatest width is about $2\frac{3}{8}$ miles. The mean width is nearly $1\frac{1}{2}$ miles, being 40 per cent. of the length. Its waters cover an area of nearly 3400 acres ($5\frac{1}{3}$ square miles), and it drains an area nearly ten times greater, or about 32,500 acres (nearly 51 square miles). The number of soundings taken in Loch Leven was 538, the maximum depth being 83 feet. The bulk of water contained in the loch is estimated at 2,195,000,000 cubic feet, and the mean depth at less than 15 feet, being 18 per cent. of the maximum depth. The length of the loch is 232 times the maximum depth, and 1296 times the mean depth.

An examination of the map shows how uneven the bottom of Loch Leven is. The deepest part of the loch is cut up into two portions, the larger depression lying to the west and south of St. Serf's Island, with a maximum depth of 83 feet—the greatest depth observed in the loch—the smaller depression being situated in the north-western part of the basin, and attaining a maximum depth of 79 feet. The larger 70-feet depression lies to the west of St. Serf, with two isolated soundings of 70 feet farther to the south-east; the smaller 70-feet depression is in the north-western part of the loch, with an isolated sounding of 71 feet. The larger 50-feet depression to the south and west of St. Serf is nearly a mile in length, while the smaller in the north-western portion of the basin is a little over half a mile in length. The larger 20-feet depression is very irregular in outline, extending from near the outlet of the loch at the river Leven along the southern and western shores of St. Serf, and sending a wide branch in a westerly direction and another in a north-westerly direction towards Castle Island, with an extreme length of about two miles. It is separated by an interval of about half a mile (in which the bottom rises in a pear-shaped elevation—a sunken island—covered by 5 to 9 feet of water) from the north-western 20-feet depression, which is apparently extremely regular in outline, being about two-thirds of a mile in length, and over one-third of a mile in maximum width. The 10-feet line follows approximately the contour of the loch, except off the eastern shore to the north of St. Serf, where the 10-feet line runs on an average nearly three-quarters of a mile distant from the shore. The 10-feet line also surrounds Reed Bower, Castle Island, and Scart Island, and in addition to the elevation in the central part of the loch already mentioned, there is another small elevation covered by depths of 3 to 7 feet near the southern shore off Waterbutts Plantation.

The area of the bottom between the shore and the 10-feet contour-line is about 1430 acres, or 42 per cent. of the whole area of the loch; that between the 10- and 20-feet contours is nearly 1450 acres, or 43 per cent.; that between 20 and 50 feet is about 375 acres, or 11 per cent.; that between 50 and 70 feet is nearly 110 acres, or 3 per cent.; and that over 70 feet is about 25 acres, or 1 per cent. It will thus be seen that no less than 85 per cent. of the bottom is covered by less than 20 feet of water, and the mean depth as already mentioned is less than 15 feet.

The details regarding the physical features of the different lochs are collected together in the following table for convenience of reference :—

Loch.	Elevation of surface above the sea.	Number of Soundings.	Length.	Breadth. Miles.		Mean Breadth per cent. of Length.	Depth. Feet.		Mean per cent of Max.	Ratio of Depth to Length.		Volume, Million Cubic Feet.	Area of Loch.	Drainage Area.	
	Feet.		Miles.	Max.	Mean.		Max.	Mean.		Max.	Mean.		Square Miles.	Total in Square Miles.	Ratio to Area of Loch.
Chon, . .	296	157	1·7	0·3	0·25	14·7	75	29·382	39·2	120	305	358	0·43	6·21	14·44
Lochan Dubh,	286	25	0·2	0·12	0·09	45·0	41	20·700	50·5	28	56	0·6	0·018	0·32	17·77
Ard, . .	105	308	2·3	1·1	0·41	17·8	107	43·863	41·0	113	277	1,150	0·94	9·76	10·38
Lake of Menteith, .	55	375	1·6	1·0	0·64	40·0	77	19·770	25·7	110	427	562	1·02	6·35	6·23
Leven, . .	350	538	3·65	2·6	1·45	39·7	83	14·869	17·9	232	1296	2,195	5·30	50·92	9·61
		1403										4,265·6	7·708	73·56	9·54

Temperature Observations.

The serial temperature observations taken in the lochs under consideration are given in the following table, but many temperature observations were taken at the surface which are not, of course, included in the table :—

Depth in Feet.	Loch Chon.	Lochan Dubh.	Loch Ard.		Lake of Menteith.	Loch Leven.		
	May 15th, 1900.	May 15th, 1900.	Aug. 6th, 1899.	May 16th, 1900.	May 14th, 1900.	June 11th, 1900.	June 22nd, 1900.	Sept. 1st, 1900.
	°	°	°	°	°	°	°	°
0	51·8	54·7	63·0	51·7	51·3	58·7	62·3	58·0
5	...	...	...	...	...	58·4	62·2	...
6	50·7	51·1	61·3	51·4	51·1	...	...	...
10	...	...	...	...	...	58·0	62·1	...
12	...	...	61·3	50·5	...	...	...	...
18	...	...	61·3	48·5	...	...	...	...
20	49·5	...	...	...	50·7	57·5	...	...
24	...	...	61·2	48·3	...	...	...	...
30	...	...	60·5	47·7	...	57·4	61·5	...
35	...	47·6	...	...	...	...	...	...
40	48·6	...	...	...	50·5	56·6	...	...
48	...	...	50·1	47·1	...	...	...	...
50	...	...	...	...	...	56·5	59·3	57·3
60	48·5	...	48·2	46·9	50·2	56·3	56·8	56·6
70	...	...	...	...	...	...	56·2	56·6
76	...	...	...	..	...	..	...	...
90	...	...	47·5	46·5	...	...	...	...
96	...	...	47·5	46·5	...	...	...	...
100	...	...	...	46·4	...	...	...	...

Loch Chon and Lochan Dubh.—These lochs were sounded on the 15th May 1900, when the surface temperature in Loch Chon varied between 51·8° and 54·5°; below the surface the temperature decreased gradually down to 48·5 at 60 feet, so that the range observed throughout the whole body of water was only about 6°. In Lochan Dubh the surface temperature was slightly higher than in Loch Chon (54·7°), while the temperature of the deeper water was observed to be about 1° lower (47·6°), so that in the small body of water contained in Lochan Dubh the range was greater than in the larger Loch Chon, viz., 7°.

Loch Ard.—Loch Ard was visited on the 5th and 6th August 1899, and again on the 16th May 1900. The highest surface temperature (64·6°) was observed in the southern prolongation of the loch in August, the maximum temperature observed at the same time in the body of the loch proper being 63°. It will be seen that the whole body of water was warmer in August, and that a drop of 10° was recorded between the depths of 30 and 50 feet, the extreme range of temperature from surface to bottom being 17°. No steep gradient was observed in May, the temperature decreasing gradually from top to bottom, the extreme range observed in May being 8·7°.

Lake of Menteith.—The Lake of Menteith was visited on the 7th August 1899 and the 14th May 1900. No serials were taken in August, when the surface temperature varied only from 62·2° to 63·2°. In May the surface temperature varied from 51·1° to 52·2°, and the temperature decreased gradually from surface to bottom, the range observed in May throughout the whole body of water being only 2°—from 50·2° to 52·2°; the extreme range shown by all the observations amounts to 13°.

Loch Leven.—Loch Leven[1] was sounded on the 11th, 12th, and 22nd June 1900, and again on the 1st September and the 23rd October. A reading at the surface on the 11th June at 5 P.M. gave 58·7°, and on the 12th June at 4.50 P.M. a temperature of 67·5° was observed—a range of nearly 9° in one day. This reading of 67·5° may be specially referred to as being, so far as we are aware, the highest temperature hitherto recorded in the waters of Scottish lochs, the next highest reading being one of 65° observed by Mr. Scott at the surface of Loch Oich in August 1897. In September the surface temperature ranged only from 57° to 58·5°. We are doubtful as to the working of the thermometer made use of in the October visit, and the readings have therefore not been included in the table.

The serials taken in June indicate the rapidity with which the waters of a shallow lake like Loch Leven become heated up in summer. During the eleven days between June 11th and 22nd the whole body of water had acquired a higher temperature, amounting to about 4° in the upper layers down to 30 feet, to nearly 3° at 50 feet, and to half a degree at 60 feet. But, while the body of water in a shallow lake absorbs heat more rapidly than that in a deep lake, it also loses heat more rapidly, and therefore the quantity of heat stored up in the waters of a deep lake may not be less than that stored up in the waters of a shallow lake, as Delebecque[2] seems to think. From a preliminary study of our temperature observations in the Scottish lochs we believe the reverse to be the case. For instance, Loch Katrine and Loch Leven are comparable as regards superficial area, but Loch Katrine is six times as deep as Loch Leven, and contains twelve times as much water; if the temperature of the water in the two lochs were taken simultaneously before and after a definite interval in summer, it seems probable that, while the temperature in Loch Leven might have been raised much higher than in Loch Katrine, the amount of heat stored up, as represented by the number of cubic feet raised 1°, would be found to be greater in Loch Katrine than in Loch Leven, and that the difference would bear some relation to the ratio between the bulk of water and the area of surface exposed to the rays of the sun. We shall endeavour to work this matter out in greater detail as our temperature observations accumulate, and we may return to the subject in a later paper.

[1] We understand that the temperature of the water of Loch Leven has been taken at the pier once a day (at 12 noon) during the five months of the fishing season for the past twenty-five years, but we have had no opportunity of examining the observations.

[2] "La quantité totale de chaleur emmagasinée dans un lac variera d'autant moins que ce volume sera plus grand par rapport à cette surface" (*Les Lacs français*, p. 150).

Deposits.

The general character and composition of the muds from the lochs under consideration do not differ from what was described in Part I. The mineral species are the same as there enumerated, and are nearly always angular. The muds contain no carbonate of lime; oxide of iron is present in them all, but appears to be in greater abundance in the Loch Chon samples.

Three brown muds were examined from Loch Chon, from depths of 10 feet, 14 feet, and 37 feet. The colour was lighter, and the mineral particles were more abundant and larger, in the shallower water. In the deposit from 10 feet the mineral particles made up probably 35 to 40 per cent., and included a few rock fragments which sometimes attained a diameter of 10 mm., the mean diameter of the mineral particles exceeding 0·05 mm. in diameter being about 0·3 mm., while in the deposit from 37 feet the percentage falls to about 10, with a mean diameter of 0·1 mm. Inversely, clayey matter and vegetable matter were more abundant in the deeper water, mixed with minute mineral particles, impregnated with ferric oxide, and containing Diatoms, Sponge spicules, arenaceous Foraminifera, and Entomostracous skeletal fragments.

A sample from the deepest part of Loch Ard was a dark-grey mud, consisting principally of vegetable and clayey matter, the mineral particles not exceeding 10 per cent., with a mean diameter of about 0·1 mm. The organic remains observed were the same as in Loch Chon.

A fine-grained dark-brown mud from a depth of 60 feet in Loch Leven contained probably not more than 5 per cent. of mineral particles exceeding 0·05 mm. in diameter, the bulk of the deposit consisting of clayey and vegetable matter, containing many beautiful Diatoms, with Sponge spicules and Entomostracan remains.

Pelagic and other Organisms.

The tow-net collections taken in the lochs now under consideration have not yet been worked up, and we therefore limit our remarks in this paper to the results obtained by Mr. Scott in Loch Leven in 1890, 1897, and 1898.[1]

In June 1890 Mr. Scott found the fauna to be abundant and varied —Mollusca, Arthropoda, Annelida, and Protozoa being more or less common all over the loch. Mollusca were common and generally distributed, except at that part of the loch called the "Shallows," the bottom of which consists of little else than fine sand, and is therefore not so suitable as a habitat for these organisms as where the bottom consists of mud or vegetable debris. Fourteen species of Mollusca were obtained, comprising five Lamellibranchs and nine Gasteropods. The more common forms were *Sphærium corneum*, *Pisidium fontinale*, *Valvata piscinalis*, and *Planorbis contortus*. The swan-mussel (*Anodonta cygnea*) appeared also to be frequent.

[1] See *Ninth* and *Seventeenth Annual Reports of the Fishery Board for Scotland*, part iii. 1890 and 1899.

The Crustacea were by far the most numerous and varied of the invertebrate fauna of the loch. Cladocera and Copepoda occurred in great profusion all over and through the water. *Daphniæ* were most abundant. *Cyclops*, especially *C. strenuus*, was also plentiful. Ostracoda were not so common in the loch itself as they were around its margin, particularly those parts that were more or less overgrown with vegetation, as round the north-east shore. Seventeen species of Ostracoda were obtained along this part of the shore; twelve species were obtained from the south shore, and only eight from the loch itself. Among the Cladocera the rare and interesting *Leptodora hyalina* occurred in considerable numbers; *Monospilus tenuirostris* was also frequent in the material collected at one or two places. The following were the common species:—*Gammarus pulex*, *Diaptomus gracilis*, *Cypria serena*, *C. ophthalmica*, *Limnicythere sancti-patrici*, *Daphnia lacustris*, *Pleuroxus trigonellus*, *Chydorus sphæricus*.

The larvæ of insects were abundant in the loch, especially the larvæ of the Iphemeridæ. The Libellulidæ and Phryganidæ were also represented in the larval stage more or less frequently. Some idea may be formed of the myriads of these organisms present in the loch when it is stated that a conspicuous ridge composed of cast-off skins of insect larvæ, which had been washed ashore during the preceding stormy weather, extended along the margin of the loch for a considerable distance. The curious so-called "water-bears" (Tardigrada), now included in the class Arachnida, were common among the decaying vegetable matter at the bottom. Species of Notonectidæ or "water-bugs," and of aquatic Coleoptera were also more or less common, though their distribution seemed to be more localised.

The worms were represented by several species—parasitic and non-parasitic. Among the former were *Schistocephalus solidus*, obtained from the body-cavity of a Stickleback (*Gasterosteus aculeatus*), and a species of tape-worm (*Bothriocephalus latus*?), several of which were found in the alimentary canal of the trout, six specimens being taken from one fish. The heads of the parasites were fixed at the extreme end of the *cæca* or blind tubes of the stomach, and their bodies were so elongated as to extend well down into the intestine. Usually one parasite occupied a *cæcum*. *Tubifex rivulorum* was very common in the loch.

Rhizopoda were common all over the loch. Several forms were obtained in the dredged and hand-netted material; the more typical varieties observed were:—*Difflugia pyriformis*, *D. globularis* (much less frequent than the first named), *D. corona* (appeared scarce), *D. marsupiformis* (of frequent occurrence). Diatomacea were abundant, especially in the deeper parts of the loch, and included a considerable number of species.

Mr. Scott visited Loch Leven again in September and December 1897, and in March and June 1898, when he found that the free-swimming Entomostraca, though very abundant, consisted mainly of the one species, *Daphnia lacustris*. *Leptodora hyalina* was moderately common in the September gathering, but was not observed in any of the other three. *Diaptomus gracilis* was frequent in the gathering collected in December, but was scarce in the others. *Bythotrephes longimanus*, though

present in both the September and June gatherings, was not observed in those collected in December and March. *Cyclops strenuus*, though present in all the gatherings, was scarce.

A few male *Daphniæ* were observed in the December gathering, but in none of the others; females with *pseudora* were frequent in all the gatherings. When the loch was examined in June 1890 both *Daphnella brachyura* and *Polyphemus pediculus* were observed in the tow-net gatherings, but neither of these species was obtained in any of the gatherings recently collected. Infusoria and micro-algæ, which were moderately frequent on the first three occasions when the loch was examined, were quite abundant in the loch in June, but these minute forms did not appear to be generally diffused, apparently occurring in shoals, and being particularly plentiful to the south of Reed Bower.

The examination of the shore yielded a much greater number of species than were captured by the tow-nets, but individuals were not nearly so numerous. Fifty-five species of Crustacea were obtained in the shore gatherings collected during the recent experiments. The records of species obtained when the loch was examined in 1890 include a few that were not observed in the recent gatherings (viz., *Cypria exsculpta*, *Candona lactea*, *Ilyocypris biplicata*, *Bosmina longirostris*, *B. longispina*), and if these and the species captured with the tow-nets be added, they increase the number of crustacean species to sixty-five; it is quite probable that even this number will yet be added to when the loch comes to be more thoroughly examined. Only five species were observed in all the gatherings in 1890, 1897, and 1898, viz., *Canthocamptus staphylinus*, *C. minutus*, *Cypria ophthalmica*, *Candona candida*, *Chydorus sphæricus*. The species recently captured include one Amphipod (*Gammarus pulex*), and eighteen each of Copepoda, Ostracoda, and Cladocera. The largest number of species of Crustacea obtained in any of the recent shore gatherings from Loch Leven was in that collected on 13th June. This gathering yielded thirty-nine species, or only four less than the total number observed in the tow-net and hand-net gatherings collected in June 1890.

The Cladocera, as a whole, were scarcer in those gatherings collected in the colder months than in the others. It may also be stated that in March the level of the water was much higher than during any of the other visits, and this no doubt accounted, partly at least, for the great scarcity of Cladocera in the gathering collected at that time; the reduced temperature incidental to the season may also have had some influence in bringing about this result.

Notes on the Geology of the District around Lochs Chon and Ard, by Messrs. Ben. N. Peach, F.R.S., and John Horne, F.R.S., from unpublished observations made during the course of the Geological Survey of Scotland.

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Loch Chon.—Loch Chon is a striking example of a rock basin. The upper portion of the lake is floored by mica-schists and the lower portion by the Ben Ledi grits and schistose epidotic grits ("Green Beds"), the members of the two latter groups being repeated by sharp folds.[1] The trend of the loch—NNW. and SSE.—is oblique to the strike of the strata. At the head of the lake there is a broad alluvial flat, where it has been silted up for a distance of one-third of a mile by the detritus laid down by the adjacent streams. In the northern part of the basin the deepest soundings vary from 33 to 37 feet; but at a point about half a mile below the present head of the lake the depth increases from 40 to upwards of 60 feet. This feature coincides with a line of fault that crosses the loch in a north-east and south-west direction, its downthrow being to the south-east. From this point southwards for half a mile there is a narrow basin enclosed within the 50-feet contour-line, and within this basin there is a narrow trough, about 100 yards long and upwards of 75 feet deep, near the west margin of the lake. There is ground for the belief that nearly the whole of the basin bounded by the 50-feet contour-line is floored by mica-schist.

About a mile below the head of the lake the soundings prove a remarkable decrease in the depth, the 25-feet contour-line near the Heron Islands being deflected towards the centre of the loch. The shallowing of the basin here takes place along the outcrop of very massive epidotic grits ("Green Beds"), several glaciated rocky islands appearing along this line. Southwards to the mouth of the lake there are alternations of Ben Ledi grits and schistose epidotic grits, the narrowest parts of the lake coinciding with the exposures of the latter group.

About 100 yards below the outlet of the lake a prominent band of schistose epidotic grits occurs, which evidently formed a rocky barrier during the glaciation of that region. Beyond this outcrop there is a small shallow basin, about 41 feet deep (Lochan Dubh), floored by schistose grits, which is traversed by a fault trending north-east and south-west, with a downthrow to the east. Across the mouth of this basin a band of massive, pebbly grits of the Ben Ledi type has been traced.

A reference to the geological map accompanying Part I. will show that the direction of the ice-flow during the great glaciation coincides generally with the trend of the loch, striæ being found on the rocky islands as well as round the margin of the lake. The evidence supplied by the soundings tends to support the theory that the basin-shaped hollow has been eroded by ice-action. The dislocations referred to

[1] "The Lochs of the Trossachs and Callander district," *Scott. Geog. Mag*, vol. xvi. p. 226.

above have doubtless produced local modifications of the floor of Loch Chon, and of that of the small basin (Lochan Dubh), but they do not account for the excavation of the basin.

Loch Ard.—Loch Ard is also a true rock basin, which lies along the outcrop of a belt of slates between two bands of grit, the deepest part of the loch, as proved by the soundings, coinciding with the outcrop of the slates.

From the Mill of Chon downwards to the head of the lake there is a small alluvial flat pointing to the former extension of the loch in that direction. At the upper end the soundings show that the average depth is 25 feet, with the exception of one small depression opposite Ledard burn, reaching 57 feet in depth. Eastwards, where the loch becomes narrower, the depth increases. The basin enclosed by the 50-feet contour-line is 1¼ miles long, while that surrounded by the 100-feet contour-line is three-quarters of a mile in length, the deepest sounding being 107 feet.

The dislocation, with a downthrow to the east, that crosses the loch in line with Allt-na-Sgéith in a north-east and south-west direction has not produced any local modification of the floor of the lake, if we may judge by the soundings. The 100-feet basin crosses this fault without any apparent increase in depth on the side of downthrow, which is probably due to the fact that the dislocation brings slates into contact with slates. The band of massive grit which forms for a long distance the southern margin of the loch evidently acted as a barrier during the period of glacial erosion. Crossing the lake at Briedach, this band of grit forms the promontory south-east of Glashart.

On referring to the geological map in Part I. it will be seen that the band of grit just described is followed southwards by slates, the outcrop of which coincides with an expansion of the loch at its outlet, the deepest sounding being 52 feet. About 600 yards to the east of the outlet the trend of the latter belt of slates is ENE., and here occurs another small basin upwards of 30 feet in depth.

No ice-markings have been found round the margin of the loch or near it; but about half a mile to the south of the upper end of the lake the direction of the striæ is E.20°S., which coincides generally with the long axis of the loch. Reference was made in the former paper to the more easterly movement of the ice as it left the mountainous region and approached the low-lying districts; the course of Loch Ard coincides with this easterly trend of the ice.

From the evidence adduced it is obvious that the geological structure of the basin of Loch Ard has had an important influence in the development of its present features, the latter being adequately explained by the theory of glacial erosion.

The Lake of Menteith lies in various superficial deposits, composed partly of boulder-clay and stratified beds of the 100-feet beach. It is within the area occupied by the Old Red Sandstone, and the solid rock is visible only at one locality, at Coilledon. Loch Leven likewise lies in superficial deposits.

TRADE AND COLONISATION IN BRITISH CENTRAL AFRICA.

By Alfred Sharpe, C.B.

(Read at the Society's Hall, Edinburgh, December 13th; also in Glasgow, December 14th.)

In addressing you to-night on the subject of British Central Africa, I feel it is especially appropriate that such a paper should be read before a Scottish audience, as the portion of Africa so officially designated—perhaps generally better known as "Nyasaland"—was first explored, and has since been steadily, energetically, and successfully developed chiefly by Scotsmen. Livingstone himself, the greatest of African explorers, spent some of his last years in it, and died there.

The term "British Central Africa" was intended to include that part of British territory north of the Zambesi river, which is bounded on the east by Lake Nyasa and the Shiré river, on the south by the Zambesi districts, north by the Congo Free State and German territory, and west by Portuguese territory. The division of it with which I am dealing to-night is composed of the British protectorate, which lies immediately west and south of Lake Nyasa, together with the country now known as "North-Eastern Rhodesia."

Attention was first drawn to Nyasaland by Dr. Livingstone; and, as is well known, he pointed to the Shiré highlands, which lie about 100 miles south of Lake Nyasa, as being one of the most suitable parts of Central Africa for experiments in the way of British colonisation and as a field for missionary enterprise. These highlands lie at an elevation of from 2000 to 4000 feet above sea-level, and have a pleasant, fairly cool climate. The bulk, indeed, of British Central Africa is over the 2000-feet level, the only low-lying portions being the trough of Lake Nyasa and the Shiré valley. The first commencement of any serious work by Europeans was the formation of mission stations. The Universities' Mission, after some preliminary work in the Shiré highlands, eventually placed their central station on Likoma island in Lake Nyasa. The Free Church of Scotland took the west side of the lake as their field; while the Established Church of Scotland formed their principal post at Blantyre, in the Shiré highlands. After a time the company, now known as the African Lakes Corporation, established itself at Blantyre. This company was, in the commencement, an offshoot of the Scotch Missions, and after, as a preliminary measure, taking up all their transport work, gradually devoted itself entirely to the general trade of the country. Numbers of other firms have since established themselves in the protectorate, both for trading and transport purposes.

In 1887 the cultivation of coffee had already been commenced by the brothers Buchanan (who were originally employees of the Established Church Mission), and was giving promise of being a profitable industry.

Towards the end of 1887 Nyasaland was threatened with a serious check to its progress on account of the advent of Arabs to the north end

of the lake. These people had been extending their influence, south from Tanganyika for some years previously, and had formed the intention of taking the whole of the northern Nyasa districts under their control. In November of that year hostilities broke out between the Arabs and Europeans, which, commencing in the siege by the Arabs of Karonga station, lasted until the year 1889. When the Arabs attacked Karonga, there were seven Europeans there: two of the African Lakes Company's employees, Messrs. Fotheringham and Nicoll (both since dead); Mr. Bain, a missionary of the Free Church (also dead); Consul O'Neil (also dead); his brother-in-law, Mr. Scott; Dr. Tommery, and myself. We succeeded in holding the station for six days till relieved by a force of many thousand Wankonde natives who came to our assistance. In the subsequent fighting both of the Messrs. Moir, joint

"Mandala," the African Lakes Corporation's Store at Blantyre, in the Shiré Highlands.

managers of the African Lakes Company, were severely wounded, one European was killed, and several others wounded. The result of these operations, however, was to completely check the Arab advance. Hostilities continued desultorily till 1889, when Sir Harry Johnston, who was sent out by her Majesty's Government to report on the existing state of affairs in the country, arranged terms of peace with the Arab chiefs. In the commencement of 1891 Sir Harry Johnston was again sent out by the Foreign Office, as Commissioner and Consul-General for the territories under British influence north of the Zambesi; and a British protectorate having been declared over the districts lying immediately west and south of Lake Nyasa, an administration was formed, with headquarters at Zomba, about forty miles north of Blantyre. The official name of "British Central Africa" was then given to the country.

Since 1891 British Central Africa has progressed and advanced in prosperity: coffee-planting has been largely developed; trade has increased; rubber-producing districts have been exploited; and, at the present date (in addition to coffee), rubber, tobacco, and other products are being exported.

The British South Africa Chartered Company (and Mr. Rhodes personally) contributed largely, in the commencement, to the financial cost of the first steps towards the establishment of an administration and a police force. But for the great interest taken by Mr. Rhodes in the country, and his ready help, its progress in the early days would have been much retarded.

In 1891 there was practically nothing in the shape of revenue locally produced: and although this has steadily grown, until at the present date it may be assessed at some £40,000 per annum, Her Majesty's Government have contributed, and still continue to contribute, large sums to provide the difference between the locally produced revenue and the cost of administration.

The protectorate was, in the first instance, garrisoned by a force of Sikh soldiers from India, and the work done by them has been beyond all praise. This force has since been augmented by a native regiment, recruited from among tribes with whom we had, during the years 1892, 1893, and 1894, a good deal of fighting. The Yaos—the finest and most intelligent tribe in the protectorate—gave great trouble up to the year 1895. After the preliminary campaign in 1891 at Mlange against Chikwmbu, we had to fight Mākenjira and his many allies—Kawinga, Matapwiri, and other Yao chiefs. Then came troubles in the Marimba country; and in 1894 the Arab difficulties at the north end of Lake Nyasa recommenced. The latter were finally disposed of in 1895, when the Arab chief Mlosi was captured, and his sub-chiefs defeated and scattered.

In 1897, Sir Harry Johnston having accepted another post, I was appointed to succeed him as Commissioner. In 1898 we were compelled, by the aggressive action of the powerful Angoni chiefs, Mpeseni and Chekusi, to send expeditions against them; their power was broken, and their countries are now being peacefully administered. Of late years there have been few native disturbances in the protectorate, and at the present time there appears to be every prospect of a prolonged peaceful period. The Yaos, Atonga, and most other tribes, have accepted our rule, and also our system of native taxation. In the commencement this was undoubtedly distasteful to them, and although the annual sum at present paid for hut-tax is a trifling one (3s.), no African likes paying any tax at all if he can help it. As civilisation has progressed, however, the natives have begun to realise, especially in the Shiré highlands, that they actually get corresponding advantages, and they now see that life and property are safe in districts where administration officials are within reach. Farther north and west, in the southern Angoni, Chepeta, and Achewa countries, the natives appear to be less intelligent than Yaos or Atonga, and more similar in appearance and customs to the Mashonas, south of the Zambesi. They are, in some parts, even now averse to all contact with Europeans, and it is only by gradual and careful steps that we are able to get into reasonable touch with them.

The climate of British Central Africa cannot be called a healthy one, although perhaps its unhealthiness has been exaggerated. There are many districts, especially in the various high plateaus of Lake Nyasa, where it is pleasant and *fairly* healthy. The months of May, June, July, August, and September are cool; the worst season of the year being, of course, the rainy one. The rains last more or less from the end of November to the commencement of April, but the really heavy rains are generally experienced during January, February, and March. Ordinary

Native dhow on Lake Tanganyika (flying German flag).

intermittent fevers are not dangerous; remittent fever even can be as a rule put up with without very great discomfort; the worst forms of fever being bilious remittent, and hæmoglobinuric (or black water) fever. Of late, great additions have been made to our knowledge of malaria. It has come to be more fully realised that this is practically the sole thing which prevents the genuine colonisation by white races of large tracts of the more elevated portions of tropical Africa. Thousands of square miles in that continent would be as livable a land as the bulk of northern Queensland, for instance, if it were not for malarial complaints. Strenuous efforts are being made to get to the root of the malaria ques-

tion. As you will be aware, H.M. Secretaries of State for Foreign Affairs and for the Colonies have taken a deep interest in the investigations being made. Schools of Tropical Medicine have been established, where it is intended that medical men taking up posts in our tropical colonies and protectorates shall first go through a special course, and thus be prepared to some extent for the diseases they will be likely to meet with. A Medical Commission was sent out by our Government in 1899 to British Central Africa, to inquire into and investigate all questions connected with malarial complaints. Dr. Daniells, the head of the Commission, has recently returned to England after a year's work in the country, and the results of his patient investigations, together with the careful observations of Dr. Douglas Gray, cannot fail to be of great assistance in the now stimulated study of this important question. Specially qualified medical experts have been sent to various spots in West Africa. Liverpool, also, which has such large interests in the West African possessions, has done a great deal to encourage scientific investigations into the cause, prevention, and treatment of malarial fever.

The European population of the British Central Africa protectorate at the present date is somewhere about 450 all told, which may be divided roughly into four divisions—traders, planters, missionaries, and administration officials. The burdens imposed on settlers in the way of taxation are light. The only export duties are on ivory and gold. Import duties are at present 5 per cent. *ad valorem* (except that one or two articles, such as alcohol and gunpowder, are more highly taxed). Certain goods are admitted free: for example, vehicles, machinery, etc. The amounts paid for licences of various descriptions are moderate.

Although the protectorate is administered from the Foreign Office, it is, I think, practically little different, to all intents and purposes, from a small Crown colony. The administrative headquarters are at Zomba, where the heads of the different departments reside. The chief judicial officer is at present stationed at Blantyre, the commercial centre, and has charge of judicial matters. There are judicial officers at various centres throughout the country who act as magistrates, who also control the district civil police, and carry out revenue and postal duties. English law is administered, as modified and supplemented by Queen's regulations, and, in the case of natives, where possible, by native custom. The Commissioner, in addition to his control of the protectorate, has now a certain amount of supervision over the north-eastern Rhodesian territory belonging to the British South African Chartered Company. In one or two settlements, such as Blantyre, Zomba, etc., which have been proclaimed as "townships," an extent of local government has been placed in the hands of the residents, and this course has proved a satisfactory one. Each township appoints its council (one of the members of which is the collector or magistrate of the district), and this body has placed in its hands the funds raised within the township by rates, for expenditure as may be required. Each district also has its road board, and in the same manner the sum of money out of the road vote which is apportioned to each district is placed in the hands of the board to be expended in what may appear to be the most necessary way.

With regard to the general trade of the protectorate, the principal occupation of Europeans is coffee-planting. In the year 1899 coffee was exported to the value of £62,000. At the present time coffee-planters are suffering from a depression in the trade. The prices realised last year were lower than what have been hitherto obtained. I am told, however, that in this respect an improvement is to be looked for. The coffee is of a superior quality and fetches a high price as compared with that grown in most other coffee-producing countries.

In connection with this industry the labour question is becoming a somewhat difficult one. Although there is a large resident native population ready to work for a very low wage, owing to the want of a railway from the head of the navigable Shiré river through the Shiré

The last of the Lake Nyasa slaving dhows.

highlands to Lake Nyasa, and owing also to the fact that not only is the trade of the protectorate increasing, but that this route into Central Africa is becoming a favourite one for large portions of German Africa and the Congo Free State, the great bulk of the native population is now occupied in carrying loads of merchandise from the lower Shiré through the highlands to the upper river, a distance of some seventy miles. Natives prefer work of this description to work on plantations; and so long as the present demand for native porters on the main road continues, planters will be short of labourers for their plantations. The "transit" trade has very largely increased during the last year or two. Goods going to districts west of Tanganyika and of Lake Mweru mostly go by the Nyasa route, as it is found the quickest and safest. This

transit trade benefits the transport companies only, and is at present detrimental to the work of the man who develops the country itself, inasmuch as it uses up all the available labour. If a short railway through the highlands to Lake Nyasa were built, this transit trade would cease to be harmful; the protectorate planter would be better able to get native labourers to assist him in carrying out his projects, and the transit trade would benefit merchants and the revenue. In order to explain the position clearly it is only necessary to look at the map of this part of Africa. It will be seen that there is a long line of water-transport extending from the mouth of the Zambesi to the northern extremity of Lake Tanganyika. Here we have a natural line of (comparatively) cheap transport some 1300 miles in length, of which only 270 requires land carriage, the remaining 1030 being by a good waterway, which, commencing at the Zambesi mouth, runs up that river and the Shiré to Nyasa, thence 350 miles up that lake, and then (after a portage of 210 miles from Nyasa to Tanganyika) for 400 miles up the latter lake. From the Zambesi mouth to the north end of Nyasa is roughly 650 miles, only 60 of which requires land carriage, *i.e.* the road which, commencing below the Shiré cataracts, runs through the Shiré highlands and rejoins the river at Matope, above the falls. [1]

The rate of wages for native workers (unskilled) is still only about 3s. per month, and this low rate has tempted employers of labour south of the Zambesi to endeavour to draw supplies from the protectorate. It has, however, been thought advisable to discourage the going away of local labour as much as possible, not only on account of the requirements of the industries of the protectorate, but also because it is found that the native himself gains little or no advantage by emigration, and distinctly suffers in many ways.

There can be, I think, no doubt, that, given the continuation of the local labour-supply, coffee-planting in British Central Africa will continue to be, as it has been hitherto, a profitable undertaking. Suitable land can always be obtained in the protectorate at 2s. 6d. per acre. Although small capital and the necessity for great economy were good in the commencement, in that this kept down the price of labour, the time has certainly come when a greater inflow of capital into British Central Africa is wanted. Many planters have been hampered by having to pay ten, twelve, and fifteen per cent. interest on borrowed money. There are, I suppose, no coffee-producing countries in the world in which there have not been many failures as well as successes, and in British Central Africa, as elsewhere, the success of a plantation depends on the choice of soil, aspect, altitude, etc. Experience seems now to point to the comparatively lower levels, *i.e.* from 1800 feet above sea-level to 2800 feet, as being best suited for the cultivation of coffee. Over the 3500 level, many plantations have been unsuccessful. As an example, however, of what *can* be done in the protectorate, I will instance a very small plantation, the details of which I am well acquainted with:—Thirty-three acres

[1] An article on Railway Schemes in relation to British Central Africa has been contributed by Mr. S. H. F. Capenny and will appear in an early number.

of land were cleared in July 1887, and a nursery formed, the plants from which were placed out in the plantation in the commencement of January 1898. This plantation of thirty-three acres produced in July 1900 nine tons of good coffee. The cost of the place, including the purchase-money of the land and everything spent upon it up to the time of picking the crop, was not over £350. And the valuation of the plantation in 1900 was placed at about £1500. As a rule coffee-planters have tried to do too much, have been tempted to plant greater areas than they could afford to keep in good cultivation, whereas the smaller estates have been among the most successful.

With regard to rubber, the export of this article has considerably

Steamers lying at Fort Johnston (south end of Lake Nyasa).

increased during the last year or two. In 1899 the value exported was a little over £13,000. There is room for great development in this direction. Up to now the only rubber exported has been that extracted from the Landolphia vine. The juice from this creeper coagulates readily merely by being rubbed on the bare skin of the native collectors, and is therefore very simple to procure. There are a variety of rubber-producing trees in the country, the juice from which requires mechanical coagulation, and which has never yet been collected. The bulk of the rubber exported comes from the Awemba country, and the districts lying immediately south of Lake Tanganyika, and round about Lake Mweru and the Luapula river. In these last-named districts there is as

yet a certain difficulty in collection, on account of the extreme apathy of local natives, and their disinclination for work of any description. When a rubber-trader enters a district he has little difficulty, at first, in getting the natives to collect and bring him rubber in exchange for trade goods. After a time, however, having procured what calico and trade they need at the moment, nothing will induce them to do more work. This, of course, is the old story in Africa. The wants of the natives being so few, it is difficult to get them to settle to any steady form of work.

Tobacco, although at present only a small export, has a promising future. In 1898 the export was 1780 lbs. only; in 1899 this had risen to 4207 lbs. I was recently informed by the only planters who have hitherto grown tobacco to any extent, that they had orders for a monthly supply of 2000 lbs. to be sent to Salisbury in Mashonaland, and that inquiries had also been received from various parts of South Africa. The war having disorganised the trade in Transvaal tobacco, that grown in British Central Africa has been able to obtain an entrance into African markets south of the Zambesi, and, as it is in every way a superior tobacco, and can be grown cheaply, the trade should increase. British Central African tobacco is well suited for pipe and cigarette smoking. American seed has chiefly been used, and the tobacco is cured by fire flues on the American system. The natives themselves grow a considerable amount of tobacco, but it is badly cured.

Chillies have been successfully grown during the last two years, and exported at prices which pay for cultivation.

Ivory as an export has fallen off, and is an article which, under the conditions prevailing hitherto, can never be looked on as a permanent export in any part of Africa. Most of that which now leaves British Central Africa comes from Tanganyika and Mweru districts. The International Convention recently entered into for the preservation of wild animals, birds, and fish in Africa has been a wise step; and if the various signatory powers frame the necessary local laws and regulations for carrying out the provisions of the Convention and vigorously enforce them, this should have the effect of putting an end to the promiscuous slaughter of immature and female elephants, and of rendering permanent for the future a duly controlled trade in an article which would otherwise gradually cease to exist.

Oil seeds are exported from the southern portion of the protectorate. They are grown on or near the banks of the navigable Shiré river, and this trade is almost entirely carried on by the Banyans or Indian merchants. Owing to the comparatively small value of oil seeds, they can only stand a cheap rate of transport, and until Nyasaland has a railway, oil seeds could not be grown profitably farther inland than Chiromo, on the Shiré.

Beeswax is exported to some extent, particularly from the southern districts of the protectorate. This is an article of export which might, I think, be largely increased, but the trading firms do not seem to have paid much attention to it as yet. Throughout north-eastern Rhodesia, and especially in the Tanganyika and Mweru districts and in the Awemba country, large quantities of wax could be obtained.

As soon as a railway has been constructed to Lake Nyasa, there can be no doubt that, by the large reduction in cost of transport to the coast, a number of other products will pay for export. Last year some 800 tons of rice were grown and sold by natives on the south-west shore of Lake Nyasa. The local cost of transport from the south end of the lake

Dead Elephant (shot at Mweru).

to the sea coast being at present about £8 to £9 a ton, rice cannot be exported at a profit.

Ebony and other valuable timbers are found all through the country, but the cost of transport prohibits any trade being done in them.

In 1899 the total value of the protectorate exports and imports was as follows :—

Exports, ...	£79,000
Imports, ...	176,000
Total trade, . . .	£255,000

a little over a quarter of a million. This, moreover, does not include the value of goods passing in transit to and from the British South

African Company's north-eastern Rhodesian territory and the Congo Free State and German territory.

With regard to minerals, British Central Africa is at present almost virgin ground. It has been ascertained that gold exists on the water-shed between Lake Nyasa and the Zambesi river; plumbago is found in large quantities and in many localities in the highlands from the north to the south end of the protectorate; and there are large deposits of magnetic iron ore: coal exists near the north end of Lake Nyasa and also near to the lower Shiré river. I understand that there is some prospect of an attempt being shortly made to ascertain by actual work and experience whether these southern coal-fields can be profitably worked.

Wheat does well in the country. The variety which has been found to succeed best is a bearded wheat, the seed for which was originally procured from Ujiji on Lake Tanganyika, where the Arabs have grown it for many years past. It is said to be unusually free from rust. The flour used by Europeans on the Tanganyika plateau is locally made from wheat grown by various mission stations south of Tanganyika. On Lake Nyasa the Dutch Reformed Church Mission have for some time past grown wheat and made flour for the local European market. Another Society, the Zambesi Industrial Mission, is now procuring good mill machinery, and intends putting a considerable acreage under wheat, and turning out sufficient flour to provide for the requirements of the protectorate. It is within the bounds of possibility that with cheap carriage to the coast, wheat might be grown for export, provided that labour-saving machinery and apparatus were used.

European settlers are endeavouring to devise some means of transport to the coast which will do away with the necessity for using native carriers. One traction-engine has already been procured, and is working fairly satisfactorily, and more have been ordered. It is very difficult, however, for traction-engines, wagons, carts, or any form of transport at present available to work during the four rainy months—December, January, February, and March; and nothing but native carriers can be used during that period, failing a railway.

Horses and mules thrive fairly well, and there is a great extent of country west of Lake Nyasa, lying at an elevation of from 3000 to 5000 feet, well suited for cattle breeding. A market is comparatively close at hand, namely in Mashonaland, whither large mobs of cattle have already been driven overland, with in every case little difficulty and a trifling loss *en route*. The whole of the southern Angoni district is one which would thoroughly suit a pastoral people of simple tastes and accustomed to a colonial life. They could themselves produce most of the necessaries of life, such as wheat, maize, potatoes, coffee, vegetables, beef, mutton, poultry, cheese, butter, milk, etc., and have a ready market for their stock.

Tsetse-fly is only found in certain belts, and the greater part of the protectorate is free from it.

The natives of British Central Africa have progressed in civilisation since the first advent of Europeans. This is especially noticeable round

about centres such as Blantyre and Zomba. There are now a number of the more advanced who have bought land from Government and formed coffee plantations. A considerable proportion of natives in the Blantyre and various lake districts can read and write either in English characters or in Arabic, the former having been taught them at the mission schools, and the latter by their Mohammedan teachers. In the Atonga district, on the west shore of Lake Nyasa, it is the exception to find natives who cannot read or write. In this district the Free Church Mission, under the wise guidance of Dr. Laws, has carried out an excellent undertaking. In addition to many years' steady work among the Atonga and kindred tribes, an industrial institution has been established at Kondowe, where natives are apprenticed and taught trades and handicrafts. I recently visited this institution, and can testify to the excellent results which

Officers of 1st Battalion Central African Regiment, with Sikh and Native Non-commissioned Officers. (Taken on the parade ground, Zomba.)

have been obtained. At Blantyre some of the natives are now well advanced in cabinet-making and furniture manufacturing.

In new districts of Africa the sudden transition from a life marked by constant wars, oppression by chiefs, and raids by stronger tribes, to a condition of peace and security, has not always in the first instance the best effect on the African. Being no longer in constant fear and ready to carry out whatever his chiefs require, or anxious to do all he can to secure the friendship (*i.e.* protection) of white men, he becomes at first absolutely lazy, and disinclined to take up any shape of work. Experience shows, however, that as he becomes further civilised his wants increase, and he becomes a more useful member of society.

Some years ago the commencement was made of a locally recruited native regiment. Lieut.-Col. Edwards, who was then Commandant of the Forces in the protectorate, took the first steps toward its formation,

A Private in the Central African Regiment.

Sikh soldiers being used as drill-instructors. After Col. Edwards's regretted death, this work was taken in hand by Lieut.-Col. Manning, the present Commandant of the Forces, who is also H.M. Deputy Commissioner. He raised and trained a battalion 800 strong, intended for service in the protectorate. Owing to the success which Colonel Manning achieved with this battalion, it was, eighteen months ago, decided by the War Office to recruit a second battalion for service outside the protectorate. The second battalion, nearly 1000 strong, was despatched

Dead Lion (shot at Mweru).

from Zomba in the first instance to Mauritius. From Mauritius they were sent to Somaliland; and a few months after the outbreak of the Ashanti war, 500 men from the second battalion were sent from Somaliland to the Gold Coast, and these, together with a contingent of 300 sent direct from British Central Africa from the first battalion, have been now for some months employed, together with the West African native troops, in suppressing the Ashanti rebellion.

Much has been written and said from time to time on the question of the "colonisation" of the more elevated portions of Central Africa.

It is true, as I have already said, that there are plateaus where white races, already accustomed to the South African or a similar climate and modes of life, might under existing conditions lead comfortable and comparatively healthy lives; but I do not think that any genuine permanent "colonisation" of any part of Central Africa by British people is possible until some practicable means are discovered of either preventing or greatly lessening the effects of malarial fevers. Of course I use the word "colonisation" in its generally accepted sense. For permanent settlement—such as is carried out in Australasia and the Americas—it is essential, as has often been pointed out, that the colonists should be able to bring out their wives

Dead roan Antelope (and Mr. P. Weatherby).

and families, and to rear their children in good health in the colony, without any necessity for periodical visits to other countries for recuperation. Under present conditions this is hardly possible in any part of Central Africa north of the Zambesi. It cannot fail to be seen, therefore, of what extreme importance are all investigations likely to result in more light being thrown on matters connected with malarial fevers and their prevention. The home population is always increasing, and it would appear that the time must come some day when we shall have to make use of every piece of territory we possess in the world which is practicable for colonising purposes.

A colonisation of these Central African districts somewhat similar to our settlements in many purely tropical countries is of course now imme-

diately possible, all that is required being easy access to the coast, and occupations and trade for the settlers. If another Johannesburg were to be discovered in any of the more elevated portions of British Central Africa, there is no question but that thriving settlements would at once spring into existence.

British Central Africa is in direct telegraphic communication with Europe, *viâ* South Africa. This is due to the enterprise of the African Trans-Continental Telegraph Company, who have steadily persevered with their telegraph line. The wire had already reached the south end of Lake Tanganyika when I left Zomba in July, and was being carried up the shore of the lake to the north. By the time it reaches Uganda it is

Ulungu Maidens.

probable that the telegraph from Egypt and the Sudan will have been carried so far south, and thus Mr. Rhodes's great project of an overland telegraph from the Cape to Cairo is within a reasonable distance of accomplishment. On this line most of the smaller stations on the route are worked by local native operators.

It would appear strange that in a paper dealing with any part of Central Africa there should be no mention of slavery; but as a matter of fact the slave-trade—that is to say, a systematic obtaining and exporting of slaves—may be said in the British Central African protectorate to have practically ceased. Formerly the most active supporters of this trade were firstly, of course, the Arabs, and secondly, the Angoni. The former have found it wise to leave Nyasaland alone. The latter (the

Angoni) have ceased their raids. In southern Angoniland the cause of the change has been the subjugation by the protectorate administration of the two chiefs Mpeseni and Chikusi. In northern Angoniland the altered condition has been brought about by the influence of Dr. Laws and of other members of the Scottish Free Church Mission. The Yaos beyond our eastern border up to last year still made occasional raids into the protectorate. It will probably require many generations to pass, even in so limited a portion of Africa as Nyasaland, before *domestic* slavery ceases; but this is a modified form, and as in the more civilised parts of the country it is now clearly understood that every man is legally free if he chooses to be so, great changes are already apparent.

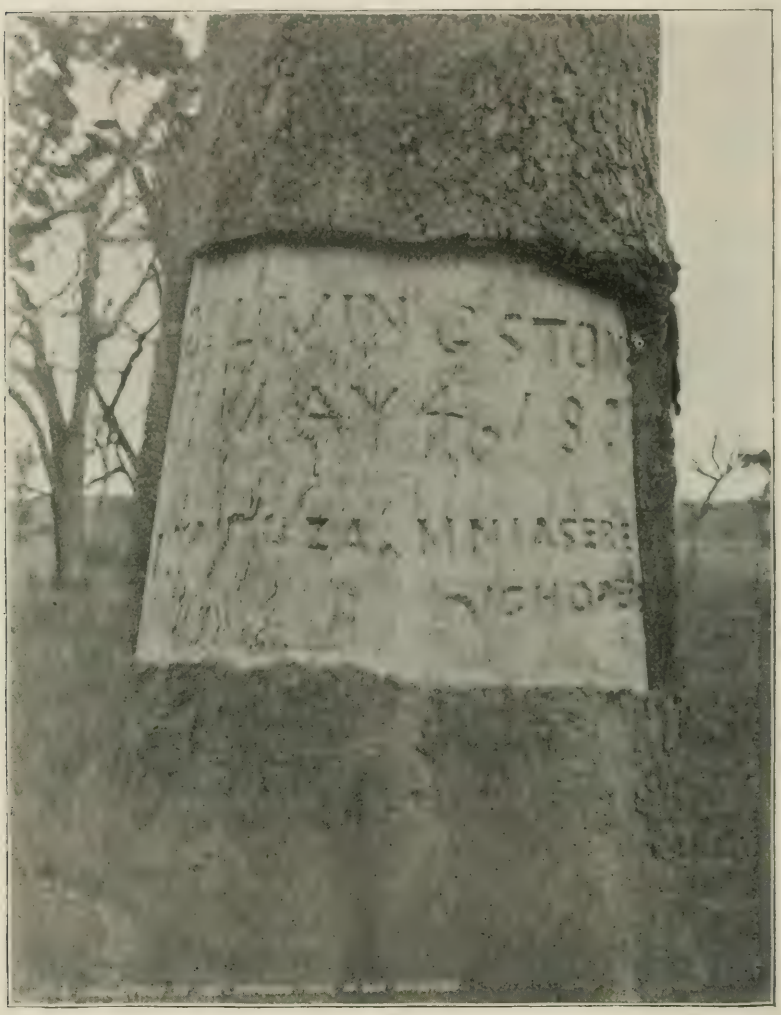
I have had occasion to speak of the work done by the various missions in British Central Africa. In that country the different societies have wisely agreed upon their respective spheres of action, and carry on their work in great harmony. It is a pleasure to me, in looking back through the term during which the administration of the protectorate has been in my hands, to think that my relations with the different societies have been very friendly ones. They have often been able to help me, and I trust that I have also been of some assistance to them.

To sum up the position of affairs in British Central Africa, so far as the past is concerned, it may be shortly said that there has been gradual, steady progress; there has been no sudden and rapid expansion, as in territories south of the Zambesi, where gold-mining has been the chief occupation. Money has been scarce, and all that has been done has been carried out by those who have had to consider carefully every pound of expenditure, and to first make sure that their money would bring them in a good return. A plentiful supply of cheap labour has been hitherto the best asset of the country.

As to the future, what is required is, firstly and chiefly, a continuation of this supply of labour, and secondly, a larger inflow of capital. A railway—when we get it—will largely help to keep up the labour-supply by releasing large numbers of men now employed on transport work.

I cannot, I think, better conclude this paper than by a few words referring to the death-place of Dr. Livingstone and the history of the rough-and-ready memorial of him left by his African followers. Livingstone, as you are aware, died in 1873 at Chitambo, in British Central Africa, near to the south end of Lake Bangweulu. Beneath a large tree his faithful servants buried his heart, his body being dried and carried by them throughout their journey of many hundreds of miles to the east coast. On this tree they carefully carved an inscription. Nineteen years later a memorial bronze plate, which had been sent by the Royal Geographical Society of England, was left by Monsieur Bià, a French explorer, in the village of Chitambo. This village was then some miles distant from the tree, which, owing to the abandonment by Chitambo of his old site, was hidden in the forest. Bià also left with Chitambo a document stating what he had done. In 1894 the English traveller Henry Glave, correspondent of the *Century Magazine*, reached Chitambo, and after some search discovered the tree and photographed

it. He was shown the paper left by Bia in Chitambo's village, and added a note to it. He found that the bronze plate left with the chief had been stolen by Arabs. A few years later the tree was visited by Mr. Weatherly and Mr. Crawford. In 1898 I proposed to the Royal



The Tree at Chitambo underneath which Dr. Livingstone's heart was buried.

Geographical Society that as the tree was reported to be fast decaying, and sure to fall soon, the section bearing the inscription should be cut out, and if possible transported to England; and the Society, acting on the suggestion, authorised me to take the necessary steps to carry this out. On my return to British Central Africa in the end of 1898, Mr. Robert Codrington, Administrator for the British South African

Chartered Company in north-eastern Rhodesia, offered to visit Chitambo, to cut out the section and despatch it home. This he succeeded in doing, and early in the present year it safely reached London, in a good state of preservation, and was handed by the Company to the Royal Geographical Society, at whose headquarters in London it now rests. Mr. Codrington, after cutting out the section, to temporarily mark the exact spot erected a high iron telegraph pole, the base of which was securely imbedded in the stump of the tree, the pole itself being strongly stayed by telegraph wire. He also took bearings, measurements, and observations, which will prevent the exact locality being ever again lost sight of.

You will be aware that the material has recently been despatched to British Central Africa for the erection of an obelisk on the spot, and I think we can be sure that this monument to the greatest of African explorers will be in future carefully guarded and kept in repair by the European settlers.

Copy of a document handed to R. Codrington by the chief Chitambo at Old Chitambo, 10th May 1899.

PROCÈS-VERBAL.

Le aujourd'hui 6 Juillet 18 quatre vingt douze nous avons réuni dans une grande palabre à MWEGE-KITAMBO les successeurs de feu KITAMBO et environ 500 indigènes à l'effet de leur remettre solennellement la garde d'une plaque de bronze sur laquelle sont gravés les mots :

"DAVID LIVINGSTONE
DIED HERE
ILALA, 1ST MAY 1873."

Le village où est mort le célèbre docteur anglais se trouve à environ 15 Ko. vers le SE. et a été abandonné complètement par les héritiers de KITAMBO à la mort de ce dernier.

Perdu au loin et au milieu des grandes herbes, ce n'est plus qu'avec hésitation que les indigènes désignent l'endroit où est enterré le cœur de LIVINGSTONE.

La plaque qui fut votée en séance extraordinaire par la Société Royale de Géographie de Londres, en mémoire du grand explorateur a donc été forcément vissée par nous sur un arbre au centre du village de MWEGE-KITAMBO.

PIANA-KITAMBO, âgé d'environ 17 ans, fils unique et successeur de KITAMBO et ses cousins : MWEGE-KITAMBO, son tuteur et KALONGA, Chef du village de MASENGA, prennent l'engagement formel de respecter et de faire respecter par les sujets et par leurs successeurs la plaque confiée à leur garde. Ils déclarent en outre que tous les Européens recevront dans tout le pays la meilleure hospitalité.

Leur engagement est consacré par l'octroi d'un présent qu'ils ont reçu et dont ils donnent décharge par le présent procès-verbal établi en double expédition.

Le Chef PIANA-KITAMBO.
(mark) +

Le Chef MWEGE-KITAMBO.
(mark) +

Le Chef KALONGA.
(mark) +

Le Commandant de l'expédition du KATANGA.
(*signed*) BIA,
Capitaine de cavalerie belge.

Le Second de l'expédition du KATANGA.
(*signed*) E. FRANCQUI,
Lieut. d'infanterie belge.

PRÉSENTS DIVERS.

Un fusil de chasse à 2 coups.
10 kilogs. de poudre fine.
1000 capsules.
2 poires à poudre.
45 pièces de mouchoirs.
3 pièces de guimpe extra.
3 pièces d'américaine.
3 pièces de bleu-stripe.
3 pièces de bleu-prints.
12 crasses de cotonette imprimée.
60 mouchoirs imprimés (animaux).
3 pièces de velours.
3 pièces de soie.
3 pièces de mouchoirs en soie.
1 sabre avec fourreau.
1 grand couteau de chasse.
3 fez rouges.
3 chapeaux en velours soutaché.
3 parasols noirs, des sonnettes, des perles, miroirs et des grelots.
Un paquet de clous de cuivre doré.

Village of MWIWOLELA, Chiefs KAWAI and TSHITAMBO,
July 13, '94.

Upon my arrival to-day at the tree in the village of TSHITAMBO where the memorial tablet to Dr. Livingstone was fixed by Capt. Bià and Lieut. Franqui, I found the village had been deserted two years ago on account of the WA-WEMBA raiders, and the plate was stolen by a big slave caravan which left the country between the R. LUAPULA and LAKE BANGWEOLO about 18 months ago in charge of two Swahili slave raiders and traders, KASAKI and KARUMA.

These two men knew their followers had stolen the plate, and made a boast of having robbed the white man's grave.

Kasaki and Karuma had for many months raided the IRAMBA Country, and when a large batch of slaves was collected they put them in chains and slave-forks and took them to the Zambezi to NYUNGWE, somewhere at the junction of the LOANGWA and Zambezi.

I have visited the exact spot where the heart of Dr. Livingstone is buried, and have a photo of the tree, with the inscription, carved by Jacob Wainwright.

The tree is situated about five miles SSW. of the village of Karonga on the R. LULIMALA.

(Signed) E. J. GLAVE,
Special Correspondent of the New York *Century Magazine*.

July 13, 1894.

NOTE.—I am indebted to Mr. Weatherly for several of the photographs from which the illustrations which accompany this paper have been produced,—notably that of the tree.—A. S.

THE LATE F. P. PULLAR.

A MELANCHOLY interest attaches to the paper on the Scottish Lochs which appears in this number of the *Magazine*, owing to the tragic death of one of the authors, Mr. F. P. Pullar, since the paper was passed for press. On February 15, while several hundred persons were skating on Airthrey Loch, in the grounds of Airthrey Castle, near Bridge of Allan, the ice suddenly gave way, and a number of people were precipitated into the water. Mr. Pullar, who was a strong, muscular young

man and a powerful swimmer, at once rushed to the rescue of those who were immersed, plunging into the water and floating ice with his skates on. He successfully assisted three of them to land, and then went to the succour of a young lady who was in an exhausted condition. It is confidently asserted by spectators, some of whom were submerged in their efforts to assist, that he might easily have saved himself had he relinquished his burden: this he refused to do. He supported the young lady for some time, but before help reached them his strength failed, and they both sank, their bodies not being recovered till three-quarters of an hour afterwards. This sad event cast a gloom over the whole district, and great sympathy was expressed for his bereaved parents, and for his only sister who had just left the ice before the accident occurred. On February 19 he was buried in Logie Churchyard, attended by an immense concourse of mourners, and amid every expression of sorrow and sympathy.

Frederick Pattison Pullar was born at Bridge of Allan on the 20th December 1875, and was the only son of Laurence Pullar, Esq., of The Lea, Bridge of Allan, and nephew of Sir Robert Pullar of Perth. In his earlier years he was rather a delicate child, and much of his education was conducted at home under private tutors. Later on his health improved, and his education was continued at the Stanley House School, Bridge of Allan, and the High School of Stirling. Afterwards he attended the Glasgow and West of Scotland Technical College in Glasgow, where he exhibited a marked ability for mathematics, mechanics, and applied science generally. He ultimately entered his father's business, but devoted a good deal of his time to scientific pursuits and studies. By his frank and genial nature he became endeared to the large number of workpeople employed by the firm of Robert Pullar and Sons.

About five or six years ago, while cruising in his father's yacht, the *Freya*, he, under the guidance of Sir John Murray, commenced to take an interest in oceanographical observations and problems, exhibiting a lively devotion to the practical work carried on at the Marine Biological Station at Millport. He enthusiastically embraced the study of meteorology, and established at his father's residence at Bridge of Allan a complete meteorological observatory, his instruments including deep earth thermometers. He became a member of the Royal Meteorological Society and of the Scottish Meteorological Society, sending in reports regularly to the last-mentioned Society during the past five or six years. He presented a complete set of meteorological instruments to the Scottish Hospital which proceeded to South Africa last year under Professor John Chiene. A room in his father's house was fitted up as his own private workshop, in which he had many ingenious and interesting mechanical, electrical, and photographic contrivances, together with considerable geological collections. He was an enthusiastic cyclist, and within the last year or two had three or four kinds of motor vehicles. He had an intimate knowledge of these machines, and his advice was frequently sought by automobilists; indeed, he proceeded to the scene of the disaster in a motor car, which was standing at the side of the loch when he met his death. He was an Associate of the Institution of Mechanical Engineers, and an active member of the Automobile Club.

About three years ago, in conjunction with Sir John Murray, he undertook a systematic bathymetrical survey of all the lochs of Scotland, and here his mechanical knowledge and inventive genius were at once exhibited by the improvements he made in the apparatus for taking the soundings. A portable machine was constructed from his designs, which could be firmly and rapidly fixed to the gunwale of the boat from which the soundings were to be taken. He also carried out many improvements in the methods of taking temperatures by means of deep-sea thermometers, in the plungers used for procuring samples of the deposits, and in the apparatus for the capture of organisms at intermediate depths. At the time of his death, among other improvements, he had in contemplation the construction of a motor engine which could be applied to the propulsion of both a car and a boat, so that he might carry with him from his home a boat for taking soundings, transfer the engine to the boat, and re-transfer it when the work was finished to the car again. The publication of the results of the researches in the Scottish lochs was commenced last year, the first instalment, dealing with the lochs of the Callander and Trossachs district, being published in the *Magazine* in April last; and the present number contains a further instalment, dealing with the remaining lochs in the Forth basin. The survey of some other lochs has been completed, but the results are not yet in a state for publication.

In September last Sir John Murray left Britain for the purpose of carrying out explorations on Christmas Island, in the Indian Ocean, and it was arranged that the paper in this Number should be put into form and passed for press by Mr. Pullar, with assistance in the *Challenger* Office. Sir John Murray returned to London on the evening of February 16, and on arrival at his hotel was handed a telegram announcing the death of his young friend on the previous day. They had made arrangements to devote most of the coming summer to the sounding of the lochs, with a view to the speedy completion of the entire survey: this important work will necessarily be interrupted by Mr. Pullar's lamented death.

Mr. Pullar was elected a Fellow of the Royal Geographical Society in 1896, and he was also a Fellow of the Royal Scottish Geographical Society; last month he was admitted to the Fellowship of the Royal Society of Edinburgh.

Mr. Pullar was beloved by all who knew him. He was a man of great bodily and mental activity, lively disposition, generous and brave, knowing no fear. His friends were justified in believing that a great future lay before him. His promising career has been cut short by an act of devotion. He sacrificed his life in an heroic endeavour to save the life of another.

> "His life was gentle; and the elements
> So mix'd in him, that Nature might stand up
> And say to all the world, 'This was a man!'"

JAMES CHUMLEY.

Challenger Office,
Edinburgh, 27th February 1901.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in February.

Mr. J. E. S. Moore was unfortunately prevented by illness from delivering the addresses in Edinburgh and Glasgow which had been announced for the 7th and 8th respectively. The meeting in Edinburgh was, however, held on the 7th, when Mr. William C. Smith, who occupied the Chair, delivered the following Address and moved the Resolution with which it concludes. The Resolution was carried by acclamation.

ADDRESS TO THE KING.

Ladies and Gentlemen,—

In accordance with the custom of most learned Societies in the Kingdom, especially of those that have received any mark of Royal favour, we propose with your consent to send an Address to His Majesty King Edward VII., of condolence on the death of his venerable and beloved mother, and of congratulation on his accession to the throne.

It is impossible to look back on the long and glorious reign of Queen Victoria without a feeling of just pride in the marvellous expansion of the British Empire, and of thankfulness to God who has appointed this lofty destiny for our race. The reign of Victoria has seen the new Government of India, the formation of the Dominion of Canada, the regeneration of Egypt, the federation of the Australian Colonies, and the definite establishment of British authority in South Africa. Her reign has seen so extraordinary a development of British manufactures and British commerce, that men are beginning to doubt whether that world-wide supremacy can be maintained. As Lord Curzon has eloquently said, the English language itself, as the instrument and vehicle of modern commercial transactions, is a leading factor in the solution of the vast problems of the Far East: and wherever that mother-language goes, whether it be spoken under the British flag or not, we believe it makes for liberty, for peace, and for civilisation.

And this external growth has been accompanied at home by the political emancipation and the social and educational improvement of the people. We are not likely to forget that, as we have been lately reminded, these two things must always keep together. By the strong hands and quick minds of the last three generations this Empire has, to a great extent, been created: and by these, or even greater, qualities in the future, the Empire must be maintained. We must do what we can to keep up the grand old British stock, and to hand on to our successors, not only the Imperial possessions, but the Imperial character itself.

Among the many-sided activities of the Victorian Age, I need not remind you that Geographical Exploration has been conspicuous. In the frozen Arctic Seas, among the mountain ranges of Central Asia, by the rivers and great lakes of the Dark Continent, the courage and the endurance of our people have been tried, and we believe that light has followed

on their footsteps. With a sincere desire to spread Geographical Knowledge, to facilitate intercourse between the Scottish people and the great travellers of our day, to increase an intelligent interest in the development of this mighty Empire, that we might realise what an inheritance is ours, with these objects this Society was founded sixteen years ago; and it is one of our happiest reflections that in 1887, when the Society may be said scarcely to have emerged from childhood, Her Majesty Queen Victoria was graciously pleased to permit us to bear the designation of the Royal Scottish Geographical Society. It is apparent from the letters of Lord Lothian and Lord Rosebery, which are printed in the *Magazine* for that year, that this was no offhand formality of state, but that, as the Queen took a keen personal interest in every worthy movement which had in view the welfare of her subjects, so she extended her grace to this Society, because she heartily approved of our objects and our work.

What is true of Her Majesty's connection with this Society is equally true of her whole public career. We have heard from experienced statesmen of her indefatigable labours as Sovereign, and of her wise judgment on critical affairs of state. We know ourselves her constant and tender sympathy with all classes of the community. How often has some wounded soldier, or the desolate widow of some poor working man, received the direct expression of the Queen's concern! The love of her people had become the ruling passion of her life. Charles Kingsley said long ago:—"Be good, sweet maid, let those who will be clever." But he could not foresee how, by the very simplicity and uprightness of her character, by her devotion to duty, and the example she gave of a kind woman's heart in the highest place amongst us, she would so powerfully contribute to the elevation of our public life, to the stability of our political institutions, and to the coherence and loyalty of the whole Empire.

In presence of the universal sorrow caused by the Queen's death, it is difficult to speak at all, and I daresay you will forgive me if I read the remarkable prophecy which Winthrop Mackworth Praed wrote about the young Queen immediately after her accession in 1837. He said this:—

"That she may see, our Bright and Fair,
How arduous is her path to fame,
How much of solemn thought and care
An Empire's interests fitly claim;
That she may know how poor 'twould seem
In one who graces Britain's throne
To patronise a Party's scheme,
Or make a favourite's cause her own;
That she may feel to whom belong
Alike the contest and the prize,
Whence springs the valour of the strong,
Whence flows the counsel of the wise;
That she may keep in womanhood
The heavenborn impulses of youth,
The zeal for universal good,
The reverence for Eternal Truth;

That she may seek the right and just,
That she may shun the false and mean,
That she may win all love and trust,
Blessing and blest—God save the Queen!"

All this was written of the girl Queen in 1837, and surely no prophecy ever received more complete and absolute fulfilment. We can no longer say "God save the Queen." We have lost our great and good Queen. But it is our consolation that we can remember her only with gratitude and pride, and that we believe the work of her life lives after her.

"Only the memory of the just
Smells sweet, and blossoms in the dust."

In the absence of our President, Sir John Murray, who is in Calcutta, I beg to move the adoption of the following Address:—

To the King's Most Excellent Majesty,

THE LOYAL AND DUTIFUL ADDRESS OF
THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

May it please your Majesty,—

We, the Royal Scottish Geographical Society, humbly desire to express our profound sympathy in the sorrow which afflicts your Majesty, the Royal Family, the Nation, and the Empire.

We cherish the memory of your Royal Mother, the late Queen, whose noble character touched the heart of the whole world, and under whose benignant reign the fortunes of our beloved country have so greatly prospered. Your Majesty has graciously declared your resolve to continue the traditions of that great example.

We pray your Majesty may for many years to come reign as constitutional monarch over a United Empire; and we ask leave to offer to Her Gracious Majesty Queen Alexandra the humble assurance that in her exalted position she is followed by the love and admiration of your people.

JOHN MURRAY, *President.*
RALPH RICHARDSON, } *Hon.*
J. G. BARTHOLOMEW, } *Secs.*

Mr. J. E. S. Moore addressed the Society in Edinburgh on the 28th February on "Some unknown Countries north of Tanganyika and the Mountains of the Moon." Colonel Wardlaw Ramsay occupied the Chair.

Meeting of Council.

At a Meeting held on the 19th February, the following business was transacted :—

Five new Members were elected, viz. :

Mrs. E. D. Gray.
William Boyd, M.A.
James W. Hunter, M.A.
Gilbert Cossar.
John Couper.

The following gentlemen were elected Corresponding Members for the Session 1900-1901 :

Count F. L. Pullé, *Bologna.*
Dr. M. A. Stein, *Punjab.*
Sir William Garstin, K.C.M.G., *Egypt.*
A. A. Dobson, C.E., *Argentina.*
J. Bryant, *New South Wales.*
Prof. James E. Talmage, Ph.D., F.R.S.E., F.G.S., *Salt Lake City.*
Wm. Anderson, F.G.S., Government Geologist, *Pietermaritzburg.*
Dr. J. C. Branner, LL.D., Ph.D., D.Sc., *California.*
Prof. Salisbury, *Chicago.*
Prof. R. Credner, *Greifswald, Prussia.*
M. Marcellin Boule, *Paris.*
Prof. G. K. Gilbert, *Washington.*
Prof. W. E. David, B.A., F.R.S., *Sydney, New South Wales.*
Dr. Gunnar Anderson, *Sweden.*
Rev. James Henderson, M.A., *Livingstonia.*
Dr. Alex. Roberts, D.Sc., F.R.A.S., F.R.S.E., *Lovedale.*
Rev. James Dewar, M.A., *Natal.*
Rev. John Ross, *Manchuria.*
Rev. Dr. Husband, C.I.E., *Rajputana.*
James Stirling, *Victoria.*

A Resolution was passed expressing the Council's sense of the loss sustained by the Society through the death of Sir Thomas Clark, Bart. A copy of the Resolution was ordered to be communicated to his family.

Mr. Bartholomew intimated that Mrs. Bruce had undertaken to endow a Livingstone Gold Medal for the Society, in memory of her father, Dr. Livingstone; the medal to be awarded as the Council may determine. The Secretary was desired to express to Mrs. Bruce the cordial thanks of the Council for this generous proof of her continued interest in the Society and its work.

Dr. J. Y. Simpson and Mr. D. Livingstone Bruce were appointed Members of Council, under Law XVI., to fill vacancies.

Scottish Antarctic Expedition.

The following letter, dated 9th February 1901, has been received by the Secretary :—

"Dear Sir,—I had an interview with Mr. Bruce yesterday evening relative to the proposed Scottish Antarctic Expedition, when I agreed to become a subscriber to the funds of the Expedition to the extent of £500, provided that it receives sufficient financial support to enable it to start.—Yours faithfully,

"George A. Cooper."

Meetings arranged for March.

Mr. J. E. S. Moore will address the Glasgow Branch on the 1st March on "Some unknown Countries north of Tanganyika and the Mountains of the Moon."

Mr. Alexander Hosie, British Consul at Newchwang, will address the Aberdeen Branch on the 4th March on "Manchuria."

Mr. Arthur Gulston, Chief Superintendent of the Elswick Shipyard, Newcastle-on-Tyne, will address the Society in Dundee on the 6th March and in Edinburgh on the 7th March on the "Baltic and Arctic Voyages of the Ice-breaker *Ermack* in 1899."

GEOGRAPHICAL NOTES.

Clarke Memorial Medal.—The Royal Society of New South Wales has awarded to Sir John Murray, K.C.B. President of the Royal Scottish Geographical Society, the Clarke Memorial Medal, in recognition of his many and long-continued services in the cause of science, and especially in recognition of the invaluable results of his labours in connection with the Reports of the *Challenger* Exploring Expedition.

University of Oxford: School of Geography.—The report for the year 1900 states that the School was opened in October 1899, but the work of the first term was merely of a preliminary character. The attendance of students during 1900 was as follows :—

Hilary Term, 95. Of these, there were 59 men from 15 colleges, and 33 women from 5 colleges or halls; the remainder were students not belonging to the University or the Association for the Education of Women. Of the 95, 60 attended only the Reader's lectures, and 25 only the lectures in Ancient Geography, while 6 received laboratory instruction, and attended all, or nearly all, the lectures.

Easter Term, 16. Of these, there were 13 men from 6 colleges, and 2 women from 2 halls. Of the 16, 6 attended only the Reader's lectures, and 5 only the lectures in Ancient Geography, while 4 received laboratory instruction, and attended all, or nearly all, the lectures.

Michaelmas Term, 100. Of these, there were 70 men from 12 colleges, and 28 women from 5 colleges or halls. Of the 100, 93 attended only the Reader's lectures, while 5 received laboratory instruction, and attended all, or nearly all, the lectures.

Among the students who were not members of the University were 1 from Sweden and 1 from the United States.

Lectures.—The following courses of lectures were delivered during the year :—

By Mr. Herbertson—

(1) "River Basins and Shore Lines" (eight lectures).
(2) "Mountain Types" (eight lectures).
(3) "The Geographical Cycle" (eight lectures).

By Mr. Dickson—

(4) "The Atmospheric Circulation" (sixteen lectures).
(5) "The Climatic Regions of the Globe" (eight lectures).

By the Reader—

(6) "The Natural Regions of the Old World" (five lectures).
(7) "The Development of Geographical Ideas" (seven lectures).
(8) "The Historical Geography of the British Isles" (seven lectures).
(9) "The Historical Geography of the Romance and Teutonic Countries of Continental Europe" (fourteen lectures).
(10) "The Historical Geography of North America, Australia, and the Cape (fourteen lectures).

By Mr. Grundy—

(11) "The Historical Topography of Greece and the Greek World" (sixteen lectures).
(12) "The Geographical Development of the Roman Empire" (eight lectures).

Laboratory Instruction.—Hilary and Easter Terms. Instruction was given in the laboratory and in the field during about 260 hours, and was attended by 4 men and 3 women. The rudiments of surveying were taught in the field, and the rudiments of cartography and elementary practical astronomy in the laboratory. The students giving the whole or a large portion of their time to the study of Geography were required to write periodical essays for the Reader.

Michaelmas Term. The course for the diploma having been organised, the laboratory instruction has, during this term, partaken of a more definite character. The following classes have been held :—

(1) "Cartographical study of the extra-European parts of the world," by Mr. Herbertson. (2) "The Figure of the Earth, and Terrestrial Magnetism," by Mr. Dickson. (3) Weekly essays for the Reader.

During this term work has been in progress from 10 A.M. to 1 P.M. each week-day. Mr. Dickson has been in charge on Monday mornings, Mr. Herbertson on the other five days. The Reader has given informal instruction on Wednesday and Friday mornings. The laboratory has also been open from 4 to 6 P.M. on Tuesdays, Wednesdays, and Fridays, when Mr. Herbertson has been in charge.

Equipment.—The three rooms on the upper floor of the Old Ashmolean Building, which have been assigned to the School, have proved to be excellently adapted for the purpose. The apparatus and maps purchased some years ago, out of a grant of £100 made by the University, have been handed over to the School, and a further sum of about £120 has been spent on the most urgently needed additions to the plant. A collection of recent maps has been commenced, and, for the greater convenience of teaching, is being arranged according to regions. It is hoped that this collection, when sufficiently complete, may enable the staff of the School to give help to graduate and other scholars in Oxford who may be engaged upon special study or research.

Diploma.—A University Statute establishing a diploma in Geography in connection with the School has been passed by Convocation without opposition. There will be an annual examination conducted by three examiners, of whom one will be the Reader. Candidates, who may be of either sex, and need not be members of

the University, will be required before admission to the examination to show that they have received a good general education, and have attended a prescribed course of lectures and study at the School, extending over one academic year. The first examination for the diploma will take place in June 1901.

While the Diploma Statute was being drafted, inquiries were addressed to a considerable number of important public schools, with a view to ascertaining whether the holders of such a diploma as was proposed would be welcomed as teachers. Favourable replies, in not a few cases conveying cordial approval, were received from thirty-two public schools for boys, and twenty-seven high schools for girls. It appears, therefore, that there should be no difficulty in placing a considerable number of teachers who, in addition to a good general education, have received special training in Geography.

The annual examination for a scholarship, of the value of £60, open to members of the University of Oxford who have taken honours in one of the final schools, was held in October 1900, and the Rev. E. C. Spicer, of New College, was elected. The scholar is required to study for a year in the School of Geography with a view to obtaining the diploma.

Among the more important donations have been (1) Kretchmer's great Atlas, in sheet, presented by the Berlin Geographical Society; (2) a series of maps of the United States, by the U.S. Geological Survey; (3) a complete set of the publications of the Royal Geographical Society (with the exception of a few volumes which are out of print), by the Society; (4) a complete set of the publications of the Royal Scottish Geographical Society, by the Society; (5) a set of Stanford's Compendium of Geography, and other books, by Mr. Edward Stanford; (6) a series of maps printed without names, by Mr. J. G. Bartholomew.

The following are among the more urgently needed appliances:—

An Eidograph; a set of *Petermann's Mittheilungen*, including the *Ergänzungshefte*; a set of the *Annales de Géographie*, including the bibliographical volumes; a set of the *Geographisches Jahrbuch*; a set of the *Geographische Zeitschrift*; a set of the *Meteorologische Zeitschrift*; the *Challenger Reports*—the volumes containing the Narrative (2), the Summary of Results (2), and the Physical and Chemical Reports, including 52 maps of Pressure and Temperature (1); Vivien de St. Martin's *Dictionnaire de la Géographie Universelle*; a set of Davis's Physiographical Models; a set of Heim's Models; and a large Globe, after Reclus's model.

The Fourth Italian Geographical Congress will be held in Milan from the 11th to the 14th of April 1901. This Congress is triennial, having met for the first time in Genoa in 1892; the last meeting was at Florence in 1898. The Executive Committee, to whom applications for membership must be made, is at the *Biblioteca Nazionale di Brera*, Milan.

Gerlache's Expedition to Kerguelen Land.—Captain de Gerlache, the leader of the Belgian Antarctic Expedition, is sailing for Kerguelen, as the representative of a French company. He is to carry 1500 sheep from the Falkland islands in the sailing ship which accompanies his steamer. It is anticipated that the conditions in Kerguelen will be favourable for the acclimatisation of the sheep. Meteorological and zoological observations will be made, the latter by MM. Ronnier and Perez.—*Mouvement Géographique.*

The Kane Medal has been awarded by the Philadelphia Geographical Society to Dr. Donaldson Smith, in recognition of his important explorations in East Africa.

The late Alexandre Alberto da Rocha de Serpa Pinto was born in 1846. He received a military education; and his first active service, in 1869, was on the lower Zambesi, where he became strongly attracted to African exploration. In 1877 he was attached to Lieutenant Capello's expedition to the upper Kunene and the Kwango, but he shortly afterwards disagreed with his leaders, and while Capello and Ivens went northward, Serpa Pinto travelled eastward to Lialui, where he was deserted by his carriers. Descending the Zambesi, he reached the mission of M. Coillard in October 1878 in a destitute condition; but with the assistance of the eminent missionary he was enabled to reach Pretoria, then in the hands of the British, in February 1879. The account of this journey was published in the work *How I crossed Africa* (1881). The Portuguese explorer undertook two more important expeditions in Africa, first in the region between Mozambique and Nyasa (1884-1886), and second, on the Shiré river (1890). His death took place at Lisbon in December of last year. In 1881 he received the Founder's Medal of the Royal Geographical Society.

The Bressa Prize.—The Royal Academy of Sciences of Turin announces that the prize of 9600 francs, founded by Dr. Cesar Bressa for the most notable and useful discovery or writing in geography or other sciences, will be awarded at the close of the year 1902.

The late Luciano Cordeiro, who died at Lisbon on December 22, 1900, was one of the most eminent of Portuguese geographers. He was born at Mirandella in 1844. After serving for a short time in the navy, he devoted himself to geographical and literary pursuits, and was appointed to the chair of philosophy and literature at the Military College. In 1875 Cordeiro founded the Lisbon Geographical Society, and served it as secretary until his death; the Society awarded him a gold medal in 1887 in recognition of his distinguished services to science and to his country. To the *Boletim* he communicated many papers, dealing chiefly with the history of Portuguese explorers and colonists, exploration and colonisation; among other works were *Memorias do Ultramar*, the story of Portuguese enterprise in the Congo and Angola in the sixteenth century, essays on Vasco da Gama, Diogo d'Azambuja, and Diogo Cão, and the *Annotações Historicas*, on which he was engaged at the time of his death. Luciano Cordeiro was a man of great energy and wide interests. In addition to his geographical work and historical work he published a book of critical essays, *Livro de Critica* (1869), founded the *Revista de Portugal e Brasil* (1873), and for a time edited the daily *Jornal de Commercio*, and later, the *Diario de Lisboa*. As a member of the Chamber of Deputies he urged the vigorous maintenance of Portuguese rights in Africa, and was appointed to represent Portugal at the Berlin Congress.

Ordnance Survey of Scotland.—The following maps were issued in the month of December 1900:—Parish Maps (Scale 1 : 2500, revised, with houses ruled, and with areas (Price 3s. each). *Aberdeenshire.*—Bourtie, XLVI. 5, 6, 11, 14; Chapel of Garioch, XLV. 1, 2; Clatt, XLIII. 2; Cruden, XXXIX. 1, 2, 3, 4; Culsalmond, XLIV. 3, 4; Daviot, XXXVI. 15; XLV. 2, 3; XLVI. 5; Ellon, XXXVIII. 1, 2, 3, 4, 5; XXXIX. 1; Fyvie, XXXVI. 15; XXXVII. 1, 2; XLV. 3; Insch, XLIV. 2, 3; Keithhall and Kinkell, XLVI. 14; Kennethmont, XLIII. 2; Logie Buchan, XXXIX. 1, 2; Meldrum, XXXVII. 9, 10, 13, 14; XLVI. 5, 6; Methlick, XXXVII. 2, 3, 4, 6, 7, 8; XXXVIII. 1; Oyne, XLIV. 3, 4; Rayne, XLIV. 4; XLV. 1, 2; Rhynie, XLIII. 2; Slains, XXXIX. 2, 3; Tarves, XXXVII. 1, 2, 4, 6, 7, 8, 9, 10, 11, 12, 14; XXXVIII. 1, 5; XLVI. 6, 11; and Udny, XLVI. 11, 14; XLVII. 5, 9. *Clackmannanshire.*—Alloa, CXXXIII. 12; Alva, CXXXIII. 12; CXXXIV. 5, 13; Clackmannan, CXXXIV. 11,

12, 13, 14, 15, 16 ; Dollar, CXXXIV. 3, 6, 11, 12, 14, 15 ; and Tillicoultry, CXXXIV. 5, 6, 13, 14. *Perthshire.*—Alyth, LIII. 14 ; LXIV. 2 ; Ardoch, CXXVI. 1, 3 ; Bendochy, LII. 13, 14 ; LXIV. 1, 2 ; Blackford, CXXVI. 3 ; CXXVII. 7 ; Blairgowrie, LII. 14, 15, 16 ; LXIV. 1 ; Clunie, LII. 13 ; Coupar Angus, LXIV. 2 ; Crieff, XCV. 11 ; Dunblane and Lecropt, CXXVI. 1 ; Glendevon, CXXVII. 7, 8, 12, 16 ; Kinloch, LII. 13, 14 ; Monzievaird and Strowan, XCV. 13 ; Muckart, CXXVII. 12, 16 ; CXXVIII. 13 ; CXXXIV. 3, 4, 11, 12 ; CXXXV. 2, 5 ; Muthill, CVII. 9, 11 ; and Rattray, LII. 15, 16 ; LIII. 13 ; LXIV. 1.

One-inch Maps (New Series—revised) of Towns and their Environs, folded in cover or flat in sheets, with roads printed in colour—*Dundee*, comprising parts of sheets 48, 49, 56, 57 (Price 1s. 3d.). With hills printed in colour—*Airdrie*, 31 : *Edinburgh*, 32 (Price 1s. 6d. each). Six-inch Maps (revised). *Argyllshire.*—Sheets 78, 177, 188, 196, 220 (Price 2s. 6d. each). Sheets 120, 136, 147, 155, 157 (165 and 166), 185, 189, 217, 233, 239A (Price 2s. each). County diagrams. Scale two miles to one inch. Printed in colours showing Civil Parishes.—*Edinburghshire ; Wigtownshire* (Price 2s. 6d. each).

Six-inch Maps (Quarter Sheets—revised). *Argyllshire.*—4 SE. ; 6 SW. ; 6 SE. ; 9 NW. ; 9 NE. ; 11 SE. ; 20 NW. ; 20 SW. ; 30 SE. ; 127 SW. (filled in with parts of Dumbartonshire) ; 135 NW. (filled in with parts of Dumbartonshire), 135 SW. (filled in with parts of Dumbartonshire) ; 143 NW. (filled in with parts of Dumbartonshire), 143 SW. (filled in with parts of Dumbartonshire) ; 181 SE. ; 242 NE. (Price 1s. each). *Perthshire.*—6 SW., 6 SE. ; 12 NW. ; 20 SE. ; 21 NE., 21 SW., 21 SE. ; 28 SW. ; 29 NE., 29 SE. ; 30 SW. ; 31 SE. ; (33A NE. and 34 NW.)—filled in with parts of Argyllshire ; 35 SW., 35 SE. ; 36 NW., 36 NE., 36 SE. ; 37 NW., 37 SW., 37 SE. ; 38 NW., 38 SE. ; 39 SW., 39 SE. ; 40 NE., 40 SW., 40 SE. ; 41 NW., 41 NE., 41 SE. ; 45 NW., 45 SW. ; 46 NW., 46 NE., 46 SW. ; 47 NW., 47 NE., 47 SE. ; 48 NW. ; 50 NE., 50 SW. ; 51 SW. ; 55 SE. ; 56 NW., 56 NE., 56 SW., 56 SE. ; 57 NW., 57 NE., 57 SW., 57 SE. ; 58 NW., 58 NE., 58 SW., 58 SE. ; 59 NW., 59 NE., 59 SW., 59 SE. ; 60 NE., 60 SW., 60 SE. ; 61 NE., 61 SW. ; 66 NE., 66 SE. ; 68 NW. ; 69 NE., 69 SW., 69 SE. ; 70 NW., 70 NE., 70 SW. ; 72 SW. ; 78 SW. ; 81 NW., 81 SE. (Price 1s. each.)

The following maps were issued in the month of January 1901 :—

Parish Maps Scale 1 : 2500, revised, with houses ruled, and with areas (Price 3s. each). *Aberdeenshire.*—Auchterless, XXXV. 8 ; XXXVI. 5 ; Chapel of Garioch, XXXVI. 14 ; Cruden, XXXI. 3, 4, 7, 9, 10, 11, 12, 13, 14, 15, 16 ; XXXII. 1, 2, 3, 9, 10, 13, 14 ; Culsalmond, XXXV. 8, 15, 16 ; Daviot, XXXVI. 10, 11, 14 ; XLV. 4 ; Drumblade, XXXIV. 8 ; Ellon, XXX. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 ; XXXI. 5, 9, 13 ; Fyvie, XXIX. 10, 11, 14 ; XXXVI. 5, 6, 7, 8, 9, 10, 11, 12, 16 ; XLV. 4 ; Gartly, XXXIV. 8 ; Insch, XXXIV. 8, 16 ; XXXV. 13, 15 ; XLIII. 4 ; XLIV. 1 ; Kennethmont, XXXIV. 15, 16 ; XLIII. 3, 4 ; XLIV. 1 ; Longside, XXXI. 2, 3, 4, 7 ; XXXII. 1 ; Meldrum, XXXVI. 7, 8, 11, 12, 16 ; XLV. 4 ; Methlick, XXIX. 10, 11, 14, 15, 16 ; XXX. 5, 9, 13 ; New Deer, XXX. 5, 6, 7, 9, 10, 11, 14 ; Old Deer, XXX. 6, 7, 8 ; XXXI. 2, 5, 9, 10, 13, 14 ; Peterhead, XXXII. 1, 2, 3 ; Rayne, XXXV. 8, 16 ; XXXVI. 5, 9, 10, 13, 14 ; and Tarves, XXX. 5, 9, 13, 14 ; XXXVI. 8. *Perthshire.*—Ardoch, CVII. 13 ; CXVII. 2, 5, 7, 8, 9, 11, 13, 14, 15 ; CXXVI. 2 ; Auchterarder, CVIII. 15 ; CXVIII. 3, 6, 7, 11 ; Bendochy, LXIV. 5 ; Blackford, CVII. 8, 12, 16 ; CXVII. 4, 7, 8, 11, 15 ; CXVIII. 6, 9, 13 ; CXXVI. 4 ; Blairgowrie, LXIII. 2, 4, 7, 11 ; LXIV. 5 ; Caputh, LXII. 4, 8, 12 ; LXIII. 5, 9, 10, 11 ; Clunie, LI. 16 ; LXII. 4, 8 ; LXIII. 1, 2, 5, 6, 7 ; Coupar Angus, LXIV. 5 ; Crieff, XCV. 8, 14, 15, 16 ; CVII. 4, 8 ; Findo Gask, XCVI. 12, 15 ; Fowlis Wester, XCV. 8, 16 ; XCVI. 9 ; Glendevon, CXXVIII. 5, 9 ; Kinloch,

LXIII. 1, 2, 6, 7; Lethendy, LXIII. 1, 5, 6, 7, 9, 10, 11; Madderty, XCV. 16; XCVI. 9, 12, 15; CVII. 4; Methven, XCVI. 12; Monzievaird and Strowan, XCV. 14; Muckart, CXXVIII. 9; CXXXIV. 8; CXXXV. 1; Muthill, XCV. 14, 15; CVII. 4, 8, 12, 13, 14, 16; CXVII. 2, 4; Rattray, LXIII. 4; and Trinity Gask, XCVI. 15; CVII. 8, 12.

One-Inch Parish Indexes. Printed in colours in two forms, one showing the 1 : 2500 Scale Maps and the other the Six-inch Quarter Sheets. Sheets 28, 46, 55; Price 1s. 6d. each.

Six-inch Maps— Revised). *Argyllshire.*—Sheets (65 and 79), 167, 168, 186, 187, 197, 198, 207, 208, 209, 218, 219, 231, 232, 239; Price 2s. 6d. each. Sheets 156, 210, 221, 229, 230; Price 2s. each.

Six-inch Maps (Quarter Sheets—Revised). *Argyllshire.*—11 NE.; 182 SE. (combined with 182 SE. Buteshire); 193 NW. (combined with 193 NW. Buteshire), 193 NE. (combined with 193 NE. Buteshire), 193 SW. (combined with 193 SW. Buteshire); Price 1s. each. *Perthshire.*—32 NE., 32 SE.; 40 NW.; 42 NW., 42 SW., 42 SE.; 46 SE.; 47 SW.; 48 NE., 48 SW., 48 SE.; 49 NW., 49 NE., 49 SW., 49 SE.; 50 NW., 50 SE.; 51 NW., 51 NE.; 52 NW., 52 NE.; 60 NW.; 61 NW., 61 SE.; 62 NW.; 68 NE., 68 SE.; 69 NW.; 70 SE.; 71 SE.; 72 NE.; 78 SE.; 79 NW., 79 NE.; 80 NW., 80 SW.; 81 NE., 81 SW.; 82 NW., 82 NE., 82 SE.; 83 NW., 83 SW.; 89 NE.; 90 SE.; 91 NW.; 94 NW., 94 NE., 94 SW.; 100 NW. (filled in with parts of Fifeshire); 101 NE. (filled in with parts of Dumbartonshire and Argyllshire), (101 SW. and SE.)—filled in with parts of Dumbartonshire and Argyllshire; 103 NW., 103 NE.; 104 NW., 104 SW.; 105 NE., 105 SE.; 106 NW., 106 SW.; 114 NE., 114 SE.; 115 NW.; 122 SE.; 123 NW., 123 NE., 123 SW., 123 SE.; 124 NW., 124 SW., 124 SE.; 125 NW., 125 SW.; 129 SE. (filled in with parts of Stirlingshire); 130 NW., 130 NE., 130 SW. (filled in with parts of Stirlingshire); 131 NW., 131 NE., 131 SW. (filled in with parts of Stirlingshire), 131 SE. (filled in with parts of Stirlingshire); 132 NW. Price 1s. each.

NEW BOOKS.

From the Cape to Cairo. The First Traverse of Africa from South to North. By EWART S. GROGAN and ARTHUR H. SHARP. Illustrated by A. D. M'CORMICK. Introduction by C. J. RHODES. London: Hurst and Blackett, Ltd., 1900. Pp. 366. Index, 2 Maps, 115 Illustrations. *Price* 21*s.*

This smartly written book, profusely and well illustrated, describes a noteworthy *tour de force* by a young Cambridge undergraduate, who, as Mr. Rhodes says in his preface, succeeded in doing that which the ponderous explorers of the world have as yet failed to do, namely, to march from the Cape to Cairo.

The object of the journey seems to have been twofold—hunting and the preliminary investigation as to a possible route for the Cape to Cairo railway which the genius of Mr. Rhodes has suggested, and which his energy and wealth is gradually accomplishing, notwithstanding the obstacles placed in his way by official pessimism, and voiced by Sir William Harcourt as a "wild-cat scheme."

The book is one which will be read by all with interest, and hunters will read with pleasure the author's remarks on shooting and trapping big game, whilst his description of their habits is both interesting and accurate. He deals specially with the hunting of elephant, lion, buffalo, and rhinoceros. Lion hunting he

considers the prettiest and most fascinating of all African sports, elephant hunting the most wildly exciting; rhinoceros shooting, he thinks, is not so dangerous as has been asserted, and with regard to buffalo, he thinks that the rinderpest has played such havoc with it that it will not survive. He does not believe in the unprovoked aggressiveness of the animal, but urges great care in following a wounded beast.

We venture to quote a few lines of his description of stalking the elephant in a dense forest.

"The stillness crushes one; a broken twig sounds like a 4·7 gun; stealthily one follows the blood spoor, eyes and ears strained to a bursting point; listening, listening, yet never a sound; the impenetrable wall of vegetation shuts one in as in a steamy tomb, and one feels that one can touch the stillness: the desire to shout grows on one with the ever-increasing nerve tension, a longing to break the spell. Somewhere—perhaps a mile, perhaps only two yards away—one knows that there is another listening. A shriek rings through the forest; the heart stands still, then thunders on again as though it would burst. The cold sweat breaks out, and one gasps for breath. Only a monkey! but the nerves are drawn tighter still, the stillness becomes all the more impressive for that shriek, the desire to go back becomes overpowering; all sorts of excuses pass through the mind; then the thought of those tusks and of the shame of failure predominate. . . . Crash! the whole forest seems to bulge and rend asunder. A gleam of white, a wicked red eye, a mass that fills the world. Bang! bang! the trees are still swaying, the whole forest surging, a whole avalanche is running amok: crash after crash, short snappy cracks and fearful rending sounds gradually merge into a swish-like driven hail, which slowly dies away. A monkey winks at one, a butterfly hovers for a moment over a spot of blood, then again that stillness, the stillness of the gloom that lurks for ever in that noisome hell of vegetation. I don't believe any mind could long stand the strain of hunting elephants in the forest . . . one ages a year every hour."

Turning now to the trans-continental railway and telegraph, our author shows that both are feasible, and morally, politically, and commercially everything argues the immediate completion of the telegraph: morally, because it is a great civilising agency; politically, because it brings our scattered dependencies into immediate touch with head-quarters; commercially, because of the immense benefit and fillip that it imparts to commerce in the districts traversed. As a matter of fact, only 1600 miles still remain to be erected, from Ujiji on the east coast of Tanganyika to Djebel Ain on the Nile.

A map is given showing the proposed route for the railway, and we are glad to see that Mr. Grogan takes into consideration the waterways which may be utilised, at any rate for many years, in joining up various sections of railway; for instance, it would be crazily absurd not to utilise the waterway of the Nile from Khartoum to Lado, where navigation is perfectly feasible throughout the whole year, and where the country can well wait the advent of a railway. So, too, lakes Kivu and Tanganyika can be utilised by steamers, and thus the project of steam communication between the Cape and Cairo will become an accomplished fact years sooner than otherwise would be the case. As far as the railway has been built, it has been a commercial success, and our author believes, and we agree with him, that the extension of steam communication will do more than anything else to civilise Central Africa, although we do not homologate the following passage:—"Finally, I wish I could induce some of the numerous philanthropists at home to see that by aiding enterprises of this description (the railway) they strike at the very root of the slave-trade, Belgian atrocities, cannibal raids, and the numerous other African diversions; and that in a few years they will assist to

educate, elevate, civilise, and perhaps eventually (say the year 2500 A.D.) to Christianise the African native more effectually than would be done in countless centuries by providing ill-advised and often worthless missionaries with the means of living a life of idleness, ease, and smug hypocrisy in a land that after all offers more attractions than a suburban villa or a Glasgow grocery establishment. There are admirable missionaries deserving of all respect, but even they do but assume the duties of the Government if they educate the natives, which is all they can do to effect any permanent good. Much missionary effort is merely misguided, much is enjoyment of a comfortable and by no means ill-paid occupation, while a very considerable amount is purely pernicious; all is a waste of money. So pass round the hat for the railways! You may even get some financial as well as spiritual returns for your money, and do not forget to book your passage for January 20, 1909, and by the time you arrive at the Cape you will have realised what a civilising influence an African railway is: my friends the Baleka cannibals will be selling pea-nuts at Bugoie Junction. And when a native with upcast eyes saunters past gently humming 'Onward Christian soldiers,' look out for your watch and cash."

This is smart writing, but ill-considered and unjust: but when the author grows in age he may grow in wisdom. He does not write of the natives sympathetically, and does not love missionaries, probably because he knows next to nothing about them (see pages 358 and 308), and the penetrating and on the whole sound discussion of the Native question is spoilt by such paragraphs as the one which follows.

"When we undertake the education of a child or beast we make them work, realising that work is the sole road to advancement, but when we undertake the education of a nigger, who, as I have endeavoured to show, is a blend of the two, we say, 'Dear Nigger, thou elect of Exeter Hall, chosen of the Negrophil, bread and butter of the missionary, darling of the unthinking philanthropist, wilt thou deign to put thy hand to the plough, or dost prefer to smoke and tipple in undisturbed content? We, the white men, whom thy conscience wrongly judges to be thy superiors, will arrange thy affairs of state. Sleep on, thou ebony idol of a jaded civilisation, maybe anon thou wilt sing "Onward Christian soldiers"'! . . .

After saying that a sound system of compulsory labour would do more to raise the nigger in five years than all the millions that have been sunk in missionary labour for the last fifty, but that the whole of stay-at-home England thinks that compulsory labour is slavery, Mr. Grogan says, "Have we not compulsory education, taxes, poor-rates, compulsory this and compulsory that, with jail as the alternative? Nor are we paid by the State for being educated. Then let the native be compelled to work so many months in the year, at a fixed and reasonable rate, and call it compulsory education, as we call our weekly bonnet-parades church. Under such a title surely the most delicate British conscience may be at rest."

It should be mentioned that one chapter (16th), Toro to Mombasa, is written by Mr. Sharp, who accompanied Mr. Grogan from the Cape to Toro.

As above indicated, the volume is admirably and profusely illustrated.

The "Overland" to China. By ARCHIBALD R. COLQUHOUN. With Frontispiece, Illustrations, and Maps. London and New York: Harper and Brothers, 1900. Pp. 465+xii. *Price* 16*s*.

The overland routes to the East have long had a potent fascination for the West. For half a century an overland highway to India has been discussed and debated, but for a decade now it has been overshadowed by the great line of railway which Russia has been building across Siberia. When this is finished, which Mr.

Colquhoun thinks will be in 1902, it will take but a fortnight to go from London to Peking. The remoteness of the Far East will then be a thing of the past.

Mr. Colquhoun has fared in many lands, but his name has long been associated with China and things Chinese. Notwithstanding his visit in 1896-97, after the war, he deemed it well to bring his knowledge up to date, and journeyed thither in 1898-99 by way of Siberia. He did not, however, follow the route of the railway all the way to Peking, but left Siberia at Kyakhta and crossed the Gobi to Kalgan. From Peking he proceeded to the Yang-tse valley, intending to go up to Szechuan, but that province was in such a disturbed state that he was obliged to renounce his intention and make his way to Yunnan from Chung-king. He then paid a visit to Tong-king. He thus covered some seven thousand miles in seven months—from the Baltic to the Gulf of Tong-king.

Mr. Colquhoun's book may be divided into seven parts. He treats of Siberia and its railway in six chapters; Peking in three; Manchuria in three; Eastern Mongolia in two; Yang-tse Valley in two; South-Western China in two; and Tong-king in one. We can only notice one or two of their salient features. In the first he gives a good account of Russia's conquest, military and economic, of Siberia. In the second he describes Peking and the life of the European colony with much appreciation. He gives an excellent account of Manchuria and Mongolia, but directs the attention of his countrymen to Yang-tse Valley, where it behoves them, along with their American kinsfolk, to exert themselves without delay if the Anglo-Saxons are not to be outdone by their Franco-Russian rivals. Here his book becomes somewhat of a pamphlet in its tone, but in all his writing there are the characteristics of knowledge and experience. In our perusal of his work we have desiderated some references to authorities where he writes not of things seen or told, but from the accounts of others. "Much of the information," he says, "is drawn from original sources, and the whole is connected by a thread of the writer's personal experiences." We have ourselves been most struck by the admirable account of the Mongolian part, and of the old commercial highway between Peking and Siberia through Kalgan, Urga, and Kyakhta. "It may here be mentioned," he says, "that the traveller who obtains Russian official assistance can cover the distance between Moscow and Peking in thirty and a half days—that is to say, by rail to Irkutsk, ten and a half days; thence to Kiachta [Kyakhta] by the post-road, three days; thence to Kalgan, over the Gobi desert, in ten days or even less; Kalgan to Peking in three days." As this will in all probability be the route for a railway, Mr. Colquhoun's account of it may well command attention.

We have only to add that the book is well illustrated, and that the maps show the successive advances of Russia, Russian Asia, Southern China, and adjoining countries, and route from St. Petersburg to the Gulf of Tong-king. There is a useful index.

The Englishman in China during the Victorian Era, as illustrated in the Career of Sir Rutherford Alcock, K.C.B., D.C.L. By Alexander Michie. 2 vols. Edinburgh and London: William Blackwood and Sons, 1900. *Price* £1, 18*s*.

It is to be hoped that as the war in South Africa draws to a close, the attention of our rulers and the nation generally will be turned to the recent events and political situation in China, which now constitute an Eastern Question far greater in importance, and probably much more far-reaching in consequences, than any other Eastern Question of the past century. The ignorance of the average elector of the history and actual conditions of China may be assumed without imputing any great slur to his intelligence or capacity, but it is a different matter when gross and culpable ignorance is found among our diplomats and in the

Foreign Office, for this means disaster to British prestige and grievous loss to British commerce and interests. We have little doubt that, in writing this book, Mr. Michie had it in his mind to enlighten the public, so as to induce them to waken up the Foreign Office, and to insist on a more intelligent, firm, consistent, and judicious treatment of the situation at Pekin. If the public still remain ignorant and apathetic it will not be Mr. Michie's fault. He has done his task well, and no one can arise from a perusal of these two volumes without recognising his masterly grasp of the subject, his lucid and perspicuous treatment of details, his just sense of proportion, his ability and willingness to see several sides of a question, his anxiety to do full justice to the Chinese, and his intimate acquaintance with their character and ways. He speaks with the authority of experience on the difficult subject of missionary enterprise in the Celestial Empire, and his observations on this should be carefully pondered by every Missionary Board, not only in Great Britain but also in America and the Continent of Europe. Missionary claims and pretensions, especially those set forth and insisted on by the Jesuits, are simply intolerable, and constitute a festering sore in the country for which there is no remedy, except their renunciation. Nor is Mr. Michie less outspoken on the failure of our diplomacy from first to last, because, although the lesson has been taught to us a thousand times, we have never realised, or at any rate we have never acted on the principle, that in China force, or the show of force, is the only means of securing the performance of even the most recent and solemn engagement on the part of the Government. Chinese diplomacy consists of evasion, duplicity, and treachery until force is applied, and their good faith is maintained only so long as force is seen to be ready to be invoked. "The key-note of all is general detestation of foreigners, special enmity to Christianity and its accessories, and aversion to the symbols of material progress. Hatred of foreigners now shows itself as a passion which binds the provinces together as nothing else has ever been known to do. Their expulsion is a cause which is held to justify the vilest deeds done in its name."

The "Englishman in China" whose career is used as the framework on which to depict the history of China and Japan during the Victorian era, is Sir Rutherford Alcock, whose services to geography are well known. We conclude with Mr. Michie's judicious appreciation of them. "To the larger public Sir Rutherford Alcock was perhaps best known by his work in connection with the Royal Geographical Society, on the Committee of which he served for twenty years. Elected President in 1876, it fell to him to receive Sir George Nares on his return from his Arctic expedition in that year, and Mr. H. M. Stanley on his return from the Congo in 1877. His various presidential addresses to the Society itself, and to the geographical section of the British Association, are replete with well-digested summaries of the progress of geographical exploration throughout the world. His comprehensive treatment of the subject assisted very much, if not to make geography a science, at least to lift it out of the region of mere technical knowledge, and to assign to the study of it the social and political significance now universally attached to the description of the earth's surface. Personally he did much to stimulate enterprise of that kind in various regions. As Chairman of the African Exploration Fund, he took an active share in the labours which resulted in the despatch of Mr. Keith Johnston and Mr. Joseph Thomson to East Africa, and, by bringing the country into notice, had such important results in the direction of the opening up of that part of the continent."

Where Black rules White: A Journey across and about Hayti. By Hesketh Prichard. Westminster: Archibald Constable and Co., Ltd., 1900. *Price* 12*s.*

The Republic of Hayti at the end of the nineteenth century, as depicted by Mr. Prichard—and we have no reason to question the accuracy of his description—is, we should say, the nearest approach to the kingdom of Topsyturveydom which now exists. In the first place, in Hayti the black man rules the white; the principal city of the island is permanently under martial law; the army, according to the best available statistics, consists of 6500 generals of division, 7000 regimental officers, and 6500 privates; the highways are watercourses, in the principal of which the writer, between 3.30 P.M. and 5.30 P.M., crossed the same river (four feet deep) eighty-one times, and then gave up counting; the bridges are such that there is a proverb, "When you see a bridge always go round it." The judges of the law-courts are not chosen because of their knowledge of law; and the President is a full-blooded black with the euphonious and sonorous name of Tiresias Augustin Simon Sam. Militarism, of the darkest and most brutal description, is the ordinary system of government. Organised and systematic peculation is the recognised and established order of things among all ranks of state officials, so that "there is a national proverb which may be rendered, 'It is no robbery to rob the state.'" The island, which at the beginning of the century was under the rule of the French, is rapidly sinking into barbarism pure and simple or, more accurately, most impure and complex. The Roman Catholic religion, which was at one time, and still nominally is, the state religion of Hayti, is being, or, it may be said, has been displaced by the cult of Vandoux, with its human sacrifices, disgusting orgies, and cannibalism. Under these circumstances it is not surprising that whereas in the beginning of the century there were 46,000 white men in Hayti, there are now less than 500, and the number, under existing conditions, is not likely to increase. For a white man can hold no land, has no chance of success in a Haytian law-court, and in all business transactions with the state is habitually swindled. The book, which is equipped with many excellent illustrations, is a direct answer in the negative to the question, "Can the black man rule himself?" and a mournful commentary on the hope that where Christianity has once been established it is certain to succeed.

Canadian Camp Life. By Frances E. Herring. London: T. Fisher Unwin, 1900. *Price* 6*s.*

In this book Miss Frances Herring introduces us to one of the many kinds of Canadian camp life, and we are fain to confess that it seems to us exceedingly dull and uninteresting. A Canadian family encamps in tents on the sea-coast at the American-Canadian boundary near the town of New Westminster, and their days are spent in riding, driving, bathing, gathering cockles, and the like—excellent remedies, no doubt, for the sufferer from influenza, on whose account the expedition is made, but not the materials from which an up-to-date novel can be constructed. Nevertheless, the two daughters, one of whom is supposed to write the book, catch husbands, whose capture, however, is not one whit more exciting than that of cockles.

A History of Norway from the Earliest Times. By Hjalmar H. Boyesen. With a new Chapter on the Recent History of Norway, by C. F. Keary. London: T. Fisher Unwin. Pp. xxxi + 572. *Price* 5*s.*

This work has been reissued as one of the well-known "Story of the Nations" series. It has much of both the merits and defects of Saga-history, and is almost

frankly uncritical. At the same time the incidents of Norway's romantic story are related with verve and spirit. We feel, however, bound to protest against the translation into modern Norwegian of the names of places in Shetland and Orkney, by which Mousa becomes Mosö, Egilshay Egilsö [? Egilsö], and Kirkwall Kirkevaag. Obviously the only legitimate choice lies between the present English form and the old Norse form of say the twelfth century.

Among the Himalayas. By Major L. A. Waddell, LL.D., etc., Indian Army Medical Corps, author of *The Buddhism of Tibet.* With numerous Illustrations. Westminster: Archibald Constable and Co.; Philadelphia: J. B. Lippencott Company, 1900. Pp. xvi + 452. *Price* 6*s.*

The journeys here described were confined to Sikhim and the eastern frontier of Nepal. The region is one of the most striking of the whole Himalayan range, containing as it does the giant Kanchenjanga, and having visible to the westward Everest and other lofty peaks in Central Nepal which have yet to be visited by the scientific explorer. It is now more than fifty years since the veteran scientist, Sir Joseph Hooker, made the journeys in Sikhim which he described in his *Himalayan Journals*, published in 1854. Major Waddell's book will not perhaps take its place beside Sir Joseph Hooker's classic work, but it is an informing and most readable record of travel and of observation. The latter embraced not only the topographical features and the physical phenomena of the country, which ranges, within narrow limits of latitude, from tropical valleys to inaccessible snowfields. It likewise took note of the natural history of this varying region. Specially, it directed attention to the ethnography of the Mongoloid inhabitants—Lepchas, Bhotiyas, and various Nepalese tribes; to the interpretation of the place-names given by them to the physical features of the country, as indicating the distribution and movement of these races; and to their religious practices and beliefs—the worship of the spirits of stream and hill-top—invaded first by the Lamaism of Thibet, and yet later influenced by modern Hinduism from the south. Representatives of these peoples are to be found along the southern face of nearly the whole course of the Himalayas. Some of the wilder and weaker among them are disappearing, or are being absorbed into surrounding tribes of more vigorous blood or better social standing. Valuable service is therefore done by observers like our author, who are able to interpret and record evidence bearing upon their primitive past.

The illustrations in the book are excellent and apposite.

Daybreak in Livingstonia. The Story of the Livingstonia Mission, British Central Africa. By James W. Jack, M.A. Revised, with an Introduction, by Robert Laws, M.D., D.D. Edinburgh and London: Oliphant, Anderson, and Ferrier, 1901. Pp. 359. *Price* 5*s.*

No Christian Mission from Scotland, or any other part of Christendom, has a history at once so romantic and so solid in its organisation and results as the Livingstonia Mission of the United Free Church of Scotland to Lake Nyasa and British Central Africa. It has just observed its semi-jubilee, by a remarkable Conference in North Rhodesia, where the great Institution, founded by our Honorary Fellow, Dr. Robert Laws, is situated on the uplands above Florence Bay, Lake Nyasa, and by large meetings in Glasgow, Edinburgh, and Aberdeen.

Mr. James W. Jack, M.A., minister of Glenfarg, having had access to the quarter of a century's records of the Mission, here tells the wonderful story in twenty chapters. Dr. Laws himself, in an introduction, vouches for the accuracy

of the narrative. The volume is illustrated by seventeen of the best pictures we have yet seen of native life and scenery in Africa, and of the operations of the Mission. Mr. Bartholomew has supplied a coloured map of the region, from the mouths of the Zambezi north to Lake Tanganyika and the Congo Free State, and west from the Indian Ocean to beyond meridian 26°. The map alone is worth the price of the volume, which we heartily commend to all.

Auf alten Wegen in Mexiko und Guatemala. Von Cæcilie Seler. Berlin : D. Reimer (E. Vohsen), 1900. Pp. 363. *Price* 20 *marks.*

The advance of Germany in wealth and luxury was never better shown than in the production of a clearly printed, beautifully illustrated, and handsomely bound volume like this, compared with the German type, absence of illustrations, and paper covers which distinguished German books of a past generation. In lively yet precise terms, the authoress details two journeys made in 1895-97 in Mexico and Guatemala, which, she assures us, are "not wild countries. The traveller who goes there to study the people, ruins, animals, plants, or whatever else takes his fancy, will gain much valuable information, but will meet with no adventures. I have often been ashamed to confess that I had had no adventures—no battles with wicked men or wild beasts, no perils of fire or water, no sunstrokes, no fastings in gloomy caverns." In Tehuantepec, a remote little Pacific coast town, the authoress was surprised to find five Germans, and thus moralises : "Wherever Europeans live, Germans are always to be found. Slowly, but surely, the German merchant conquers the world. We found no Englishmen on our journey, and Americans only where railways were being made, or in mining districts or great towns. More often we found Frenchmen, but most frequently Germans." She declares that the women of Tehuantepec are not only the most beautiful in Mexico, but also the cleverest, and adds that no Revolution was ever begun there without their being found in the front rank.

This work contains no fewer than 325 admirable illustrations, mostly from photographs, and it may fairly be said that no recent geographical publication excels the present in elegance. There is also a large, well-executed map by Herr P. Boschann, showing the authoress's routes.

The Romance of Spain. By Charles W. Wood, F.R.G.S. London : Macmillan and Co., Ltd. New York : The Macmillan Company, 1900. Pp. xv + 378. *Price* 10*s.*

The romance of Spain, according to Mr. Wood, lies not so much in its varied scenery, in the character of its people, or even in the beauty and grace of its ladies, as in its ancient history as gathered from its old ecclesiastical and historical buildings, of many of which this delightfully written book gives us most graphic and interesting descriptions. The author some five years ago entered Spain by the usual route from Paris, *i.e.* by Fontarabia. Thence he went to St. Sebastian, Burgos, Segovia, and Madrid, where he of course visited the famous Escurial. The most southern point of his expedition was Toledo. Thence he returned north by Avila, Salamanca, Valladolid, and Semancas, at which last-mentioned place he inspected the famous archives, which in the hands of recent historiographers have shed so much fresh light on the events of the reigns of Queen Elizabeth and James I. of England. So far as the actual travelling is concerned, it appears to have been much less comfortable or agreeable than might be expected in the end of the nineteenth century. The trains were slow ; the inns, or perhaps we should call them the hotels, were primitive ; the landlords were barely civil, and the cooking was detestable. But the discomfort which he and his susceptible friend, whose

personality is discreetly veiled by initials, experienced was more than repaid by the intellectual and artistic pleasure they derived from the inspection of the wondrous antique buildings with which the country abounds.

Those who have read Mr. Wood's *In the Valley of the Rhone* do not need to be told that he has a graphic and facile pen, the appreciative eye of a keen observer and lover of nature and art, and in an eminent degree the faculty of setting forth what he has seen in so lucid and perspicuous a way that the reader has no difficulty in following him. The bulk of this book consists of descriptions of buildings mostly ecclesiastical, a subject in which it would be easy to become monotonous and wearisome, but Mr. Wood from first to last holds the attention of his readers with graphic and vivid descriptions, fairly free from abstruse technicalities, clothed with enthusiasm and even with eloquence. If we had to make a choice, we would select his chapters on Toledo as the best in the book. Toledo, "where the voice of the Goth echoes amid Roman ruins, and the step of the Christian treads on the heel of the Moor." Its antiquity cannot be doubted, although we may question the traditions that "the sun at its creation was placed over Toledo and Adam was its first king," and we may be permitted to be sceptical as to whether the cathedral was first erected to the Virgin Mary when she was alive. There are ninety illustrations which have been specially prepared for this work, and which give excellent ideas of the appearance of the ancient buildings which, according to Mr. Wood, constitute the true romance of Spain.

Australien und Tasmanien. Nach eigener Aufschauung und Forschung wissenschaftlich und praktisch geschildert. Von Dr. Joseph Lauterer. Freiburg im Breisgau: B. Herder, 1900. Pp. 482. *Price* 11 *marks.*

President of the Royal Society of Queensland, Dr. Lauterer here contributes a most valuable volume on Australia and Tasmania. After describing, from a scientific standpoint, the voyage through Egypt, the Red Sea, and Indian Ocean, he details the discovery and political history of Australia. He next describes its geology, and gives what he claims is the first condensed account of the latest geological discoveries in Australia. Then follows a chapter upon its climate and meteorology, to which he devoted special attention. Very erudite and interesting chapters follow upon the flora and fauna of Australia and Tasmania, whilst their black aborigines, their colonists, their topography, and an excellent index terminate a volume which is one of the most learned, and, at the same time, most complete which has ever appeared upon Australia and Tasmania. Its translation into English will, we trust, be early undertaken.

Dr. Lauterer's style is at once interesting and exact. Take his remarks on clothing: "Life, manners, and customs are the same in Australia as in England. People go clothed in tropical and sub-tropical Queensland just as in cold and damp London. Postmen and policemen groan beneath heavy uniforms. Children are so swathed in flannel as to become quite weak, and chronic bronchitis and asthma are commoner and more dangerous than in Germany. Black coats and tall hats (here called "swallow-tails and toppers") are as necessary in Australian society as in Berlin or Paris. The white Indian helmet is more irksome than the felt hat, as it heats the brow, but straw hats are worn only by dwellers in the bush. Two-wheeled carriages have improved the fashions considerably. How ladies can go about in summer clad in flannel bodices and silk can only be explained by the extraordinary fatigue the human body is capable of sustaining." Dr. Lauterer attaches much importance to Roman Catholicism in Australia, but the census of 1891 showed that whilst about 75 per cent. of the population were Protestants, only 22 per cent. were Roman Catholics.

PLATE I

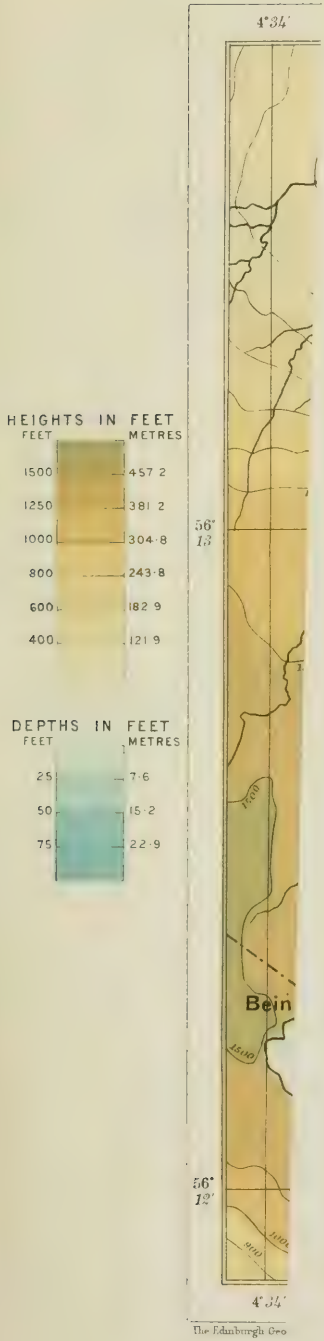

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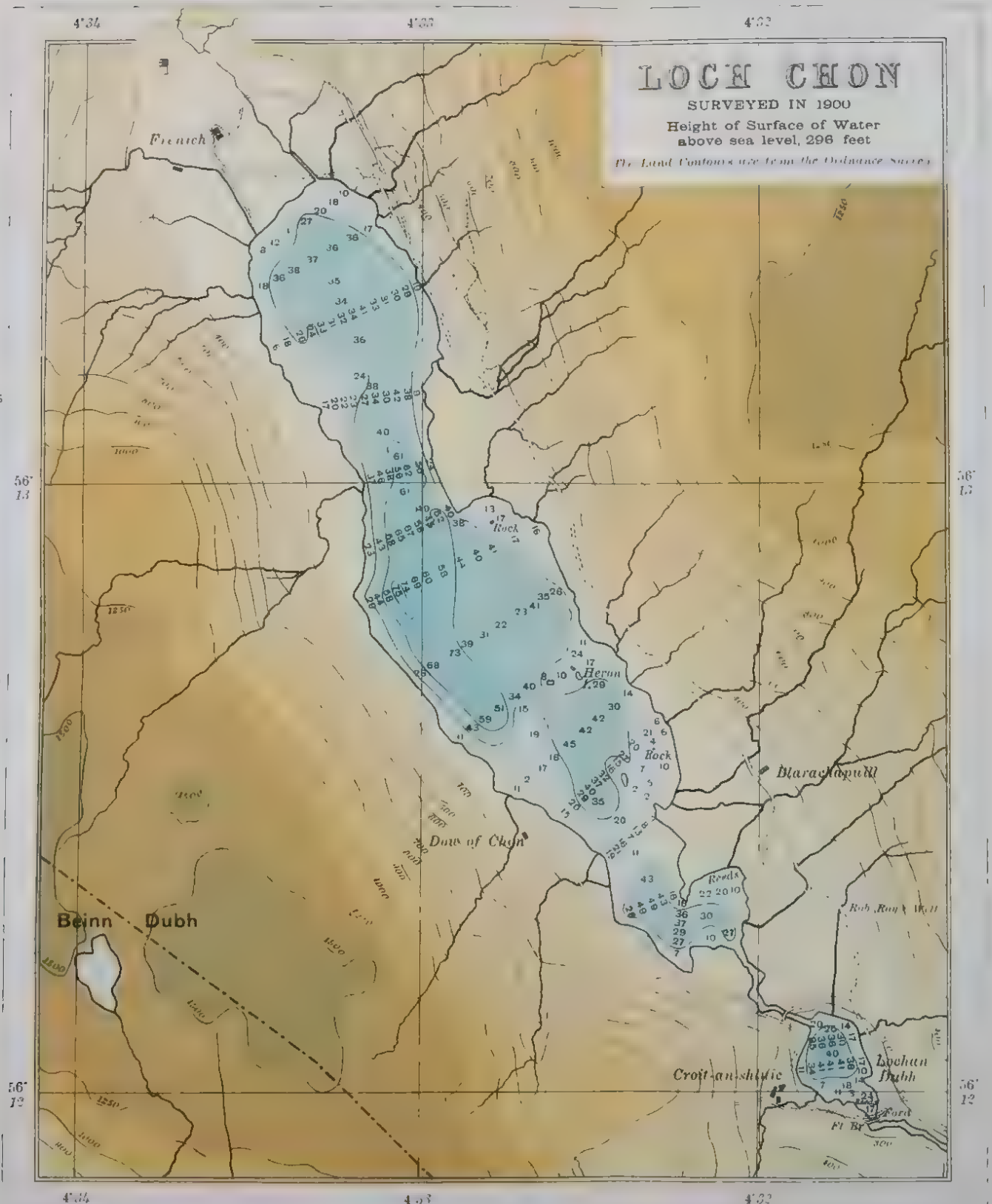
PLATE I

BATHYMETRICAL SURVEY OF THE SCOTTISH LOCHS.

BY SIR JOHN MURRAY, K.C.B., LL.D., F.R.S., AND FRED. P. PULLAR, F.R.G.S.



The Edinburgh Geographical Institute

Scale 1 21120 3 INCHES TO 1 MILE

Miles 1

Kilometres 1 61

0·21 KILOMETRE = 1 CENTIMETRE

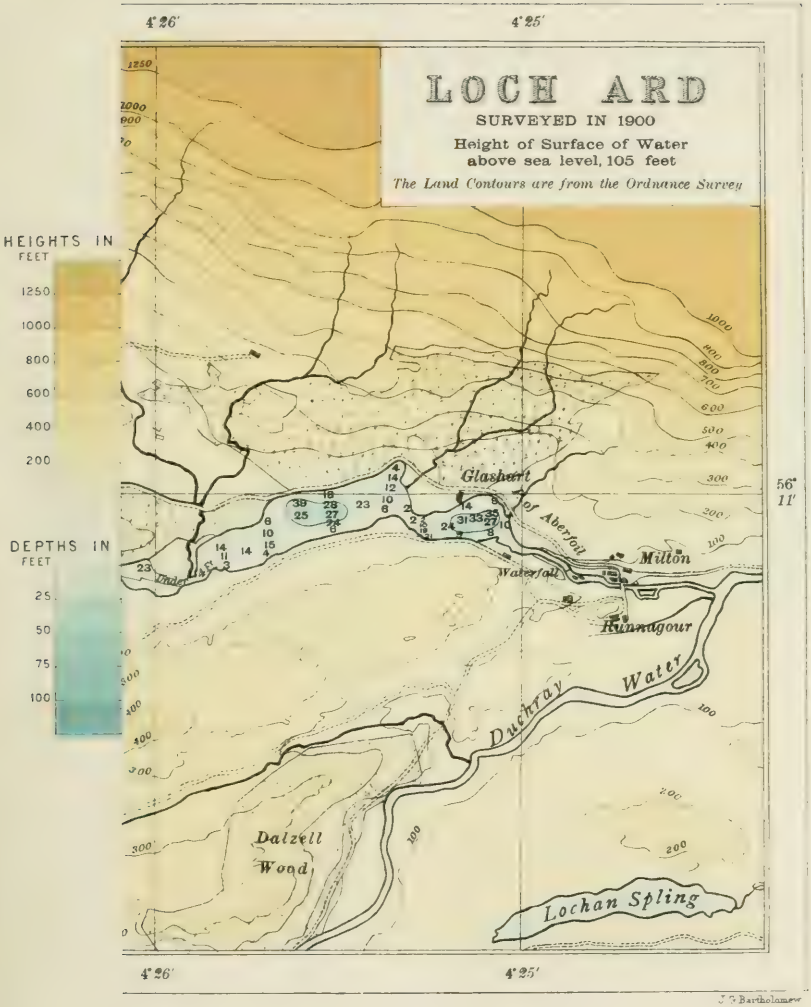

LOCH ARD
SURVEYED IN 1900
Height of Surface of Water
above sea level, 105 feet
The Land Contours are from the Ordnance Survey
HEIGHTS IN FEET
1250
1000
800
600
400
200
DEPTHS IN FEET
25
50
75
100
4°26'
4°25'
56° 11'
Glashert
Loch of Aberfoil
Waterfall
Milton
Rinnagour
Duchray Water
Dalzell Wood
Lochan Spling
J. G. Bartholomew

PLATE II

BATHYMETRICAL SURVEY OF THE SCOTTISH LOCHS.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., and FRED. P. PULLAR, F.R.G.S.

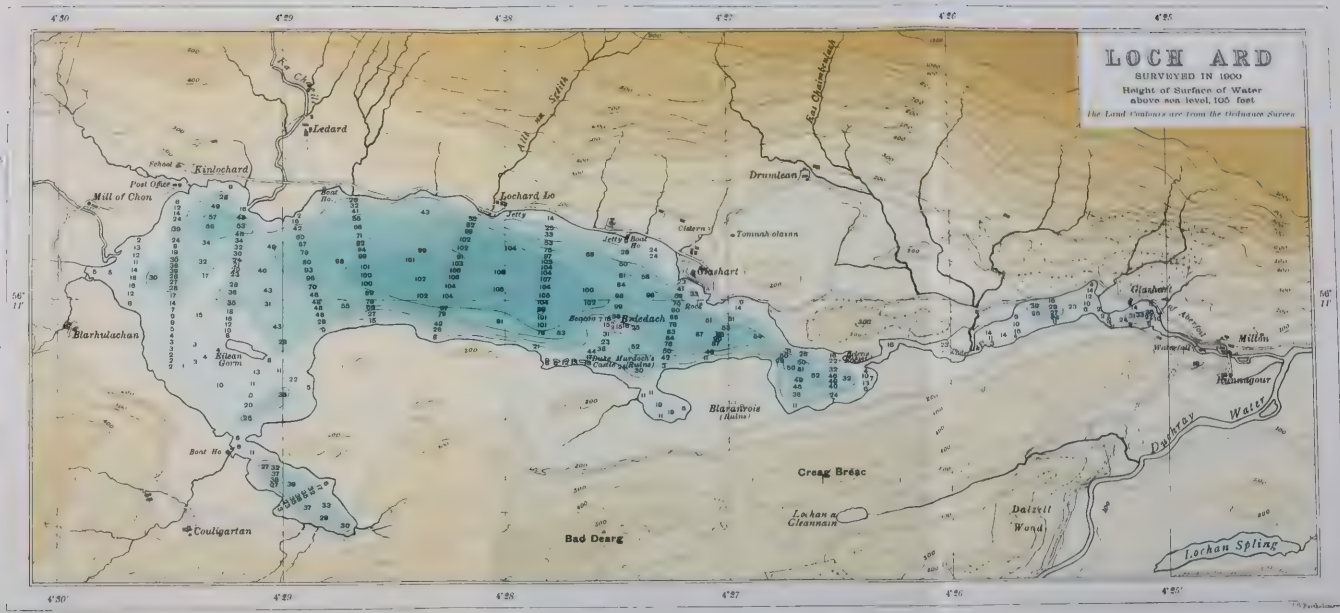


PLATE III

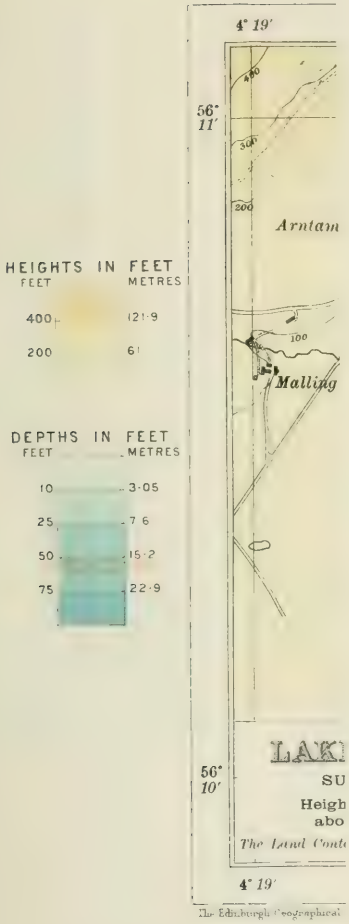
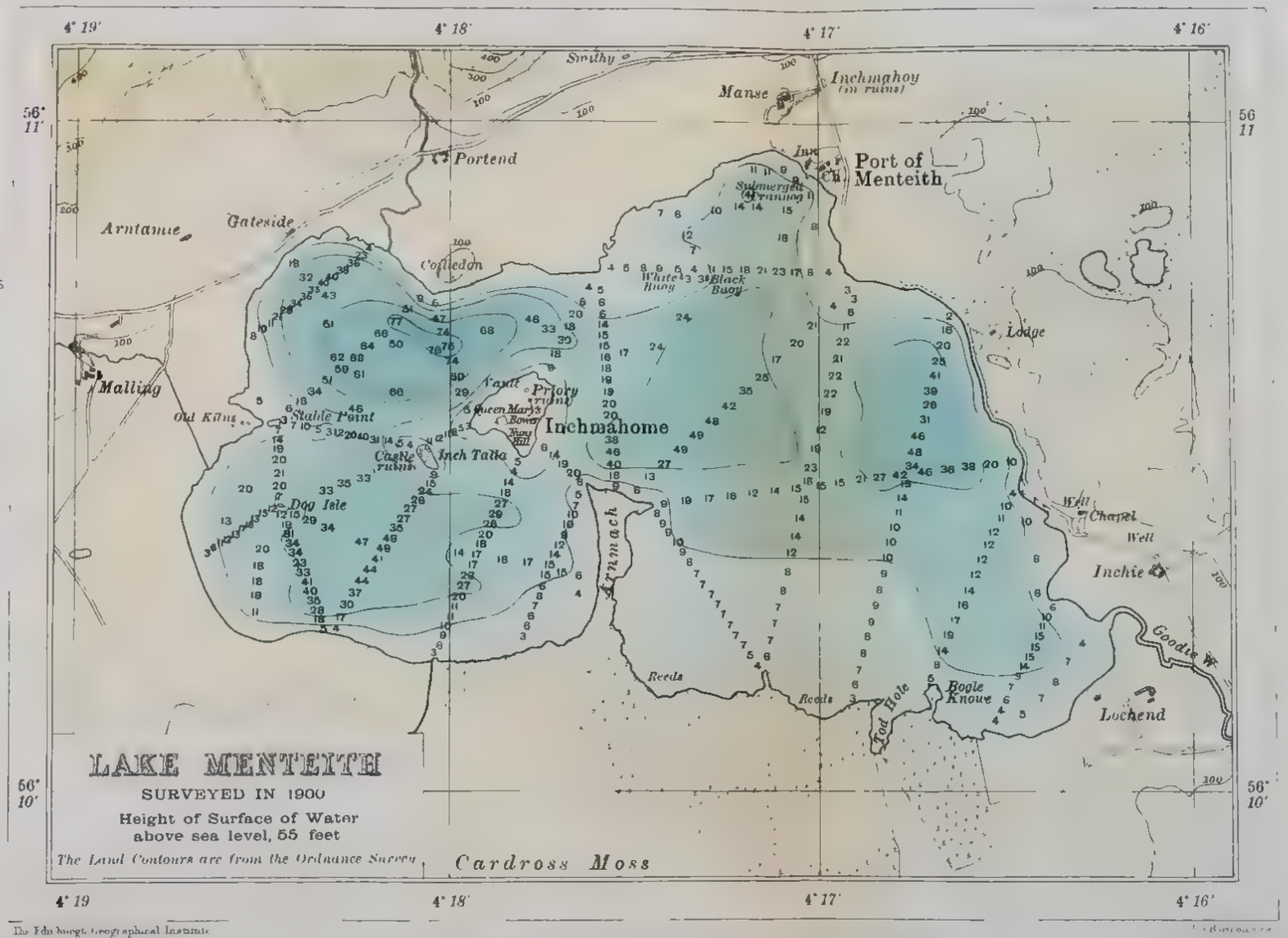

HEIGHTS IN FEET
FEET
METRES
400
121·9
200
61
DEPTHS IN FEET
FEET
METRES
10
3·05
25
7·6
50
15·2
75
22·9
4° 19′
56° 11′
400
300
200
Arntam
100
Malling
LAK
SU
Heigh
abo
The Land Conte
56° 10′
4° 19′
The Edinburgh Geographical

PLATE III

BATHYMETRICAL SURVEY OF THE SCOTTISH LOCHS.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., and FRED. P. PULLAR, F.R.G.S.



HEIGHTS IN FEET

FEET	METRES
400	12 9
200	61

DEPTHS IN FEET

FEET	METRES
10	3 05
25	7 6
50	15 2
75	22 9

The Edinburgh Geographical Institute

Scale 1 · 21120 3 INCHES TO 1 MILE

0 1 Mile 1

0 1 Kilometres 1 61

0 21 KILOMETRE — 1 CENTIMETRE

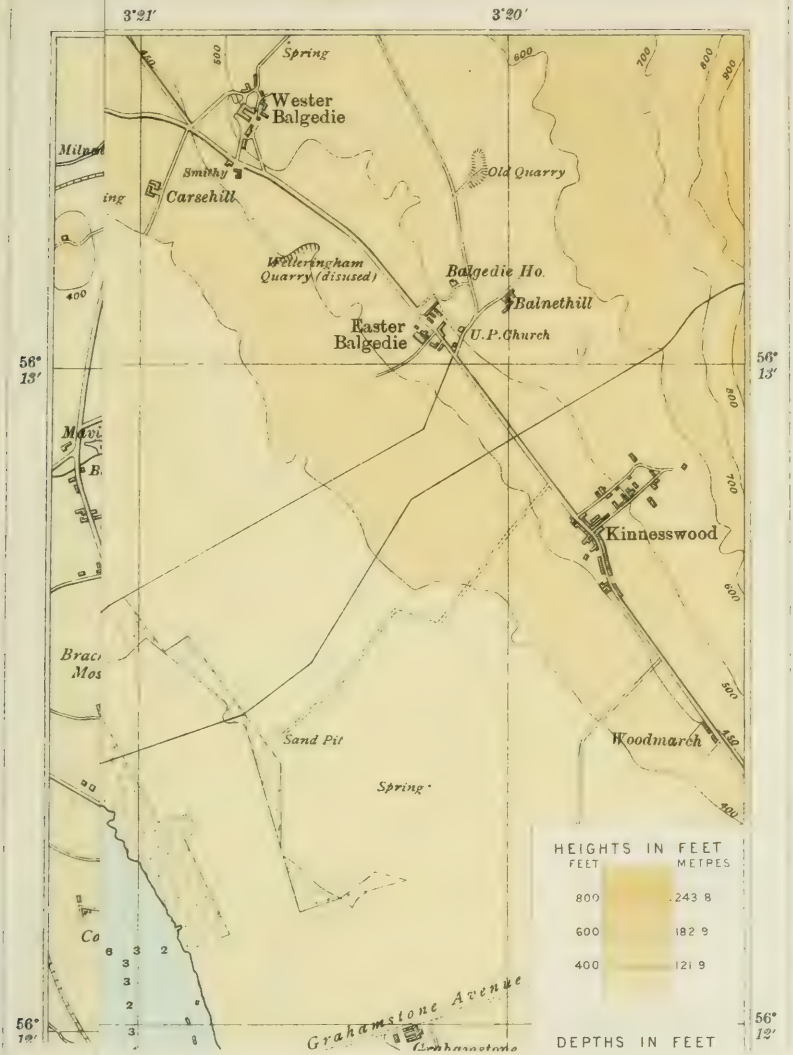

3°21′
3°20′
Spring
Wester Balgedie
Old Quarry
Smithy
Carsehill
Wellingham Quarry (disused)
Balgedie Ho.
Balnethill
Easter Balgedie
U.P. Church
56° 13′
Kinnesswood
Sand Pit
Woodmarch
Spring
HEIGHTS IN FEET
FEET
METRES
800 243 8
600 182 9
400 121 9
DEPTHS IN FEET
Grahamstone Avenue
56° 12′

PLATE IV

BATHYMETRICAL SURVEY OF THE SCOTTISH LOCHS.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., and FRED. P. PULLAR, F.R.G.S.

J. G. Bartholomew

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

A BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.

By Sir John Murray, K.C.B., D.Sc., F.R.S., and the late Fred. P. Pullar, F.R.G.S., F.R.S.E.

Part III. The Lochs of the Tay Basin.

1. *Lochs Ericht and Garry.*

Introduction.

It is proposed to publish the results obtained in the lochs forming part of the drainage basin of the Tay as ready, and in this first instalment we shall deal with Lochs Ericht and Garry. The general conclusions will be reserved until the lochs of the whole basin have been surveyed. We have referred in Part I. to Mr. Grant-Wilson's work on some of the lochs of the Tay basin ; he has kindly supplied us with copies of his maps showing the soundings taken by him. We propose as opportunity offers to take soundings supplementary to, and corroborative of, those taken by Mr. Wilson, and indeed we have already taken about 150 soundings in Loch Earn. The geology of the district around Lochs Ericht and Garry has not yet been systematically worked out, and therefore any notes by Messrs. Peach and Horne will be reserved until the completion of the survey of the lochs in the basin.

Maps and Illustrations.

This part is illustrated by three maps, and a temperature diagram. The maps are drawn to the same scale as has been adopted for the whole series, viz., three inches to the mile (1 : 21, 120), the majority of the

soundings being given in feet. The intervals between the contour-lines of depth are indicated by different shades of blue, and the intervals between the contour-lines of height of the neighbouring country by shades of brown.

Plates I. and II. show Loch Ericht, which, in order to avoid an extremely long map, has been cut into two portions, the contour-lines of depth being drawn in at 50, 100, 200, 300, 400, and 500 feet.

Plate III. is a longitudinal section of Loch Ericht, showing the distribution of temperature as observed on June 15th to 20th, 1900: this will be referred to in greater detail under temperature observations.

Plate IV. shows Loch Garry, the contour-lines of depth being drawn in at 25, 50, 75, and 100 feet.

Depths of the Lochs.

Loch Ericht.—Loch Ericht is a large Highland loch situated partly in Perthshire and partly in Inverness-shire, at a high elevation among the Grampians. It is one of the wildest and most magnificent lochs of Scotland, presenting all along its shores scenes of lonely grandeur and sublimity, the mountains rising from the water's edge to great altitudes, their sides scarred by mountain torrents. The surface when measured by the Ordnance Survey officers in 1872 was found to be 1,153·4 feet above the level of the sea: it is thus one of the most elevated of the larger Scottish lochs. It is known to anglers as the home of large *Salmo ferox*, as well as of trout said to be equal in quality to those of Loch Leven. It trends in a north-east and south-west direction, and is broadest near the southern end, narrowing gradually towards the northern end. It is over 14½ miles in length, and over one mile in maximum breadth: the mean breadth is about half a mile, being 3½ per cent. of the length. Its waters cover an area of over 4600 acres (or nearly 7¼ square miles), and it drains an area seven times greater, or over 32,000 acres (nearly 50½ square miles). The total number of soundings taken in Loch Ericht was 488, which show that it is a comparatively deep loch, the greatest depth observed being 512 feet. The mass of water contained in the loch is estimated at 38,027,000,000 cubic feet, and the mean depth at 189 feet, being 37 per cent. of the maximum depth. The length of the loch is 150 times the maximum depth, and 405 times the mean depth.

The deepest part of the loch is in the southern broader portion, where, about 3½ miles from the foot of the loch, there is a small central depression, about one-third of a mile in length, and covering about 58 acres, in which the depths exceed 500 feet, the maximum being 512 feet. There are two 400-feet depressions, the larger, about three miles in length, reaching to about 1½ miles from the southern end, and enclosing the 500-feet depression. Separated by about a quarter of a mile from the northern end of the large 400-feet depression is the second smaller isolated depression, in which the maximum depth is 410 feet. There are two 300-feet depressions, the larger in the southern portion of the loch, the smaller in the northern portion. The

southern depression is over 4½ miles in length, and encloses the deepest water in the loch. The northern smaller depression is under one mile in length, with a maximum depth of 314 feet, and approaches to within 2½ miles of the head of the loch. There are two 200-feet depressions; the larger runs from within a mile of the southern end to more than half way towards the northern end, being over seven miles in extreme length. It is separated from the northern 200-feet depression by an interval of 2¾ miles, in which the depth varies from 127 to 194 feet. The northern 200-feet depression is nearly 2¾ miles in length, approaching to within about 1¼ miles from the northern end, and enclosing the small northern 300-feet depression already mentioned. The 100-feet depression is a continuous area extending from within less than half a mile of the southern end to within less than a mile of the northern end, and is about 13¼ miles in total length. The 50-feet depression follows approximately the contour of the loch. Opposite Loch Ericht Lodge an isolated sounding of 44 feet was observed between the 50- and 100-feet lines, and about 1½ miles farther down, opposite the entrance of the Allt Càmus nan Cnàmh, another isolated sounding of 20 feet was taken, surrounded by deeper water.

The area of the bottom of the loch lying between the shore and the 50-feet line is estimated at about 880 acres (or 19 per cent. of the total area of the loch), that between the 50-feet and 100-feet contours is estimated at 695 acres (or 15 per cent.); that between the 100- and 200-feet contours is estimated at about 1160 acres (or 25 per cent.); that between the 200- and 300-feet contours at about 875 acres (or 19 per cent.); that between 300 and 400 feet at 476 acres (or over 10 per cent.); that between 400 and 500 feet at about 474 acres (or over 10 per cent.); and that over 500 feet at 58 acres (or 1¼ per cent.).

It will thus be seen that Loch Ericht is of very simple conformation. The deeper parts are divided into two basins, by the constriction in the outline of the loch in the vicinity of Loch Ericht Lodge, where, in one place, it is less than a quarter of a mile in width, but even here the depth in the centre exceeds 100 feet.

Loch Garry.—Loch Garry[1] lies to the east of Loch Ericht, at a still higher elevation, and the scenery round about is very wild; the height of the surface of the loch above sea-level is not given on the Ordnance Survey map, but a height of 1326 feet is shown near the outlet, so that the level of the loch is probably about 1320 feet above the sea. In trend and in outline it somewhat resembles Loch Ericht, narrowing towards the northern end. It is over 2½ miles in length, the maximum width being over a quarter of a mile; the mean breadth is slightly under a quarter of a mile (being 9 per cent. of the length). Its waters cover an area of about 390 acres (three-fifths of a square mile), and it drains an area thirty-seven times greater (or about 22½ square miles). The total number of soundings taken in Loch Garry was 141, the maximum depth observed being 113 feet. The mass of water contained in the loch is estimated at about 846,000,000 cubic feet, and the mean depth at nearly 50 feet

[1] This loch must not be confounded with the larger Loch Garry in Inverness-shire.

(being 44 per cent. of the maximum depth). The length of the loch is 119 times the maximum depth, and 260 times the mean depth.

Loch Garry forms a simple basin, except that the bottom sinks into two depressions exceeding 100 feet in depth, separated by depths of 82 to 93 feet. The larger but shallower depression is situated in the southern half of the loch, and is over a quarter of a mile in length, the maximum depth observed therein being 105 feet. The smaller but deeper depression is situated in the northern half of the loch, being only about one-sixth of a mile in length, and containing the maximum depth of the loch—113 feet. The 75-feet, 50-feet, and 25-feet depressions form continuous areas, following approximately the outline of the loch. The 75-feet depression is nearly $1\frac{3}{4}$ miles in length, the 50-feet depression nearly 2 miles in length, and the 25-feet depression $2\frac{1}{4}$ miles in length.

The area of the bottom between the shore and the 25-feet contour-line is about 117 acres (or 30 per cent. of the total area of the loch); that between the 25- and 50-feet contour-lines is about 83 acres (or 21 per cent.); that between 50 and 75 feet is almost the same; that between 75 and 100 feet is about 87 acres (or 22 per cent.); and that over 100 feet is about 19 acres (or 5 per cent.).

The details regarding the physical features of Lochs Ericht and Garry are collected together in the table on the opposite page.

Deposits.

The deposits from Loch Ericht are interesting because of the evidence of layers of different colours. At a depth of 50 feet a red sandy mud was obtained; at 112 feet the mud was white beneath and brown on top; at 124 feet it was all brown; at 153 feet all brown; at 182 feet sandy and white: at 184 feet white and brown; at 245 feet the deposit was a light-coloured mud, with a thin brown layer one inch in thickness on the top; at 270 feet it was white below, black-brown above; at 366 feet the mud was all dark-brown; at 385 feet there was a white clay or mud, with a dark layer on the top; at 456 feet the mud was all black; at 497 feet a section of black mud 5 inches in thickness was obtained; and at 510 feet the same black mud was found, without any trace of the lighter-coloured mud.

The sand from 50 feet consisted largely of mineral particles (probably 70 per cent. of the whole deposit) with a mean diameter of about 0·6 mm., one or two rock fragments attaining a diameter of 7 mm. The remainder of the deposit consisted of clayey and vegetable matter, with minute mineral particles less than 0·05 mm. in diameter, Diatoms, Sponge spicules, and Entomostracous skeletal remains. The light-brown mud from 150 feet contained about 30 per cent. of mineral particles, with a mean diameter of 0·5 mm., the largest being 5 mm. in diameter, with clayey and vegetable matter, and organic remains as previously mentioned. The dark-brown mud from 366 feet contained only about 10 per cent. of mineral particles (quartz, black and white mica, etc.) exceeding 0·05 mm. in diameter, the mean diameter being about 0·2 mm. Samples

Loch.	Elevation of Surface above the Sea.	Number of Soundings.	Length.	Breadth.		Mean breadth per cent. of length.	Depth.			Ratio of Depth to length.		Volume, Million Cubic Feet.	Area of Loch.	Drainage Area.	
				Miles.			Feet.								
	Feet.		Miles.	Max.	Mean.		Max.	Mean.	Mean per cent. of Max.	Max.	Mean.		Square Miles.	Total in Square Miles.	Ratio to Area of Loch.
Ericht, . .	1153	488	14·5	1·0	0·50	3·5	512	189·201	37·0	150	405	38,027	7·21	50·39	6·99
Garry, . .	1320	141	2·55	0·3	0·24	9·4	113	49·910	44·2	119	270	846	0·61	22·34	36·62
		629										38,873	7·82	72·73	9·30

of the two different-coloured layers of mud from a depth of 385 feet were submitted to analysis with the following results:—

	Bottom layer.	Top layer.
Organic matter, . . .	10·00 per cent.	26·8 per cent.
Insoluble residue, . . .	73·70 ,,	57·6 ,,
Iron oxide, ...	13·64 ,,	17·2 ,,
	97·34	101·6

These analyses seem to show that the upper layer contained more organic matter (presumably vegetable matter) and a little more iron than the lower layer. Microscopic analysis of the two layers indicates that the mineral particles were rather more numerous and larger in the top layer, while the clayey matter seemed to be more abundant in the lower layer.

Temperature Observations.

The serial temperatures taken while sounding out Lochs Ericht and Garry in June 1900 are given in the following table, and those taken in Loch Ericht are shown graphically in the temperature section (Plate III.) accompanying this paper, since they are extremely interesting as illustrating the effect of the wind upon the distribution of temperature.

Depth in Feet.	Loch Garry.	Loch Ericht.					
	June 21st, 1900.	June 19th, 1900, ½ mile from S. end.	June 20th, 1900, 1½ miles from S. end.	June 20th, 1900, 3½ miles from S. end.	June 16th, 1900, 9¼ miles from N. end.	June 15th, 1900, 5¼ miles from N. end.	June 20th, 1900, 1 mile from N. end.
	°	°	°	°		°	°
0	57·0	47·3	49·0	50·0	50·0	53·2	55·1
5	...	47·0	48·7	49·7	...	...	...
6	...	...	...	...	50·0	...	...
10	56·9	47·2	47·8	49·5	...	...	...
25	...	...	...	...	49·9	...	...
30	49·5	46·1	47·5	48·6	...	...	54·2
40	...	...	...	45·8	...	...	...
50	...	44·6	44·7	44·7	44·8	...	52·3
60	46·3	43·4	...	...	...	...	...
75	...	42·6	43·2	...	...	...	44·0
98	...	...	...	...	...	41·5	...
100	...	42·2	...	42·9	42·6	...	...
105	46·0	...	..	...	...	...	...
120	...	...	...	...	...	...	42·7
150	...	41·3	...	...	...	...	...
200	...	...	...	41·0	41·1	...	...
300	...	...	...	40·7	40·5	...	...
400	...	...	...	40·5	40·5	...	...
500	...	...	...	40·5	...	...	...

Loch Ericht.—Like Loch Katrine, Loch Ericht is said never to freeze over, and the surface temperature remains comparatively low throughout

the summer. The surface temperatures taken in Loch Ericht during the visit from 15th to 20th June show a range of 10·4°, viz, from 46·6° to 57° ; the higher temperatures were obtained towards the northern end of the loch, and the lower temperatures towards the southern end of the loch. A glance at the temperature section (Plate III.) based upon the observations given in the table shows that the warmer water was all collected towards the upper end of the loch, as the result of a south-easterly wind which blew at times during the six days that were devoted to the survey of the loch, colder water having been drawn up at the opposite end of the loch to supply the place of the warmer surface water driven before the wind.

Loch Garry.—Loch Garry was visited on the 21st June 1900, when the surface temperature was found to vary from 57° at the south-west end to 59·4° at the north-east end, and this would seem to indicate a distribution of temperature similar to that observed in Loch Ericht, but since only one temperature series was taken, it is impossible to form an idea of the distribution of temperature throughout the whole body of water.

SOME NOTES ON THE BALTIC AND ARCTIC VOYAGES OF THE "ERMACK" IN 1899.

By ARTHUR GULSTON, Superintendent Engineer : Sir W. G. Armstrong, Whitworth, and Co.

ICE-BREAKERS were in existence as far back as the year 1870, the first being a converted tug at Cronstadt ; but only in the last decade have they reached large dimensions : such as the railway ferry ice-breaking steamers on the great lakes of America and at the straits of Mackinaw ; some built on the Tyne, one of them for Helsingfors in Finland, another for Odessa ; ice-breakers at Reval, Riga, Copenhagen, Hamburg, and Vladivostock ; and railway ferry ice-breaking steamers for Saratov, and for carrying the trains of the Siberian railroad across Lake Baikal, a distance of 52 miles, where the ice varies from 2 to 3 feet in thickness, and being fresh-water ice, is very tough and hard.

The step from these vessels to the *Ermack* is a big one. She is the outcome of the fertile brain of Admiral Makaroff, of the Imperial Russian Navy. He had advocated for some years that one or more large ice-breakers be built to keep the ports of Cronstadt and St. Petersburg open all the winter ; as, practically up to the advent of the *Ermack*, these ports were closed by ice for about five months in each year, with consequent loss to commerce, the locking up of the naval arsenals of Cronstadt and St. Petersburg, and the placing of the Baltic fleet in winter quarters. Such a stupendous undertaking naturally caused much discussion and opposition amongst those interested ; and especially excitement amongst the inhabitants of Cronstadt, which, being an island, would be

cut off from the mainland by the canal cut by the *Ermack*, the traffic across the ice to Cronstadt from the mainland being exceptionally heavy. It was also well known that the ice-packs in the Gulf of Finland in some winters were of very large dimensions, and much difficulty was expected in breaking them down, the opponents of the scheme hoping that no ice-breaker could possibly crush through them ; and as no certain *data* had been obtained of the Baltic ice up to the arrival of the *Ermack*, some little anxiety was felt by those on board as to the results.

Among other means in the earlier stages that Admiral Makaroff adopted to bring his views before his countrymen was the reading of a paper before the Geographical Society of Russia in St. Petersburg on the subject of large ice-breakers. His Majesty the Czar saw a report of this lecture in one of the papers, and spoke to his Minister of Finance, Mr. de Witte, on the subject, telling him to investigate the matter and report to him. The upshot was that a commission was formed for the building of the vessel, and tenders were obtained, with the result that the contract was placed and the vessel built on the Tyne.

The *Ermack* is 335 feet in length, 71 feet beam, and about 8000 tons displacement, with her coals and stores on board. She was propelled by four sets of triple expansion engines of 2500 indicated horse power each, and has six very large double-ended boilers of 160 lbs. pressure for generating steam. One of the engines was situated in the bow of the vessel, but is now removed to give a better form for ice-crushing at the fore-end, as although the bow engine was useful in Baltic or one-year-old ice, the conditions of the large and harder ice of the Polar regions required a more powerful form of wedge-shape at the bow. The *Ermack* is capable at half power of putting 1300 tons of weight on the ice to crush it down ; this is at her ordinary ice-breaking draught of 22 to 23 feet. The other three engines are placed near the stern of the ship. It is, of course, absolutely necessary that the moving portions of the machinery, the shafts and propellers, should be made enormously strong to withstand the heavy shocks and blows met with in negotiating the ice ; and so far the machinery and propellers have withstood the tremendous trials to which they have been subjected. The boilers are clothed all over, and special means are adopted to prevent cold air entering the boiler-rooms and causing sudden contractions on any portions of the boilers. The ship is built of steel, having a complete double skin fore and aft, so that, should the outer shell be pierced by the ice, the ship would float on her inner skin, and, as there are a very large number of compartments, the amount of water let in would be reduced to a minimum ; by this form of construction great strength is given to the vessel to resist the shocks when ice-breaking. The bow is enormously strong, and for a considerable distance the frames are only 12 inches apart ; the ice-belt in the shell plating is 1½ inches thick, and the connection of the plating to the stem-piece is of the strongest description. The ice-belt at the bow portion of the vessel extends to the keel, and at the sides of the ship is 27 feet deep. The angle of the bow is 70 degrees, the sides are at 20 degrees, and the whole ship is built and shaped to withstand ice pressure, whether lateral or vertical.

There are ample means for heating the vessel by steam, also the circulating water, and for keeping the sea inlets clear of ice. The circulating water can also be discharged at the bow or stern to wet and melt the snow, so as to prevent it sticking to the ship and producing great friction. Pumping arrangements were also put in of very large capacity for "heeling" the ship, for "tipping" her fore and aft, and to clear and move her when fast in the ice; and salvage arrangements are fitted to pump out large quantities of water, or to salve another ship in distress. The accommodation is very luxurious when compared with other vessels that have hitherto been to the Polar regions. The ventilation is of the most scientific description, and was found to act admirably in the cold weather. So marvellously is the vessel constructed, that she is practically ice-proof and nearly unsinkable —qualities that give her a vast superiority over any ship which has hitherto navigated the Polar ocean.

The vessel left the Tyne on her maiden voyage for Cronstadt early in March 1899, under the command of Captain Vassilieff, Admiral Makaroff also being on board. On the Sunday week after sailing, the ice blink was seen just before dark came on, and at nine at night the first drift-ice was met off the western end of the harbour of Reval. As a heavy gale was blowing it was thought more prudent to wait until the morning before entering the ice, and it was during this wait that we saw an enormous meteor fall in Finland about 40 miles from us, making night as brilliant as day: portions of this meteor were shown in the Paris exhibition of 1900. I would here explain that out in the Gulf of Finland the small drift-ice is first met; this gradually grows to a paste which in calm weather soon solidifies into floes, which get larger until the solid ice is met, and in this the packs of ice are found. Early on Monday the ship was again steered for the ice, entering the drift about 4.30 A.M., which we continued to pass through until 7.30 A.M., when the field-ice began to be met, and shortly afterwards the ship was ploughing her way steadily through the solid ice. The packs of ice from here to above the island of Sescar were very thick and heavy, with only little water showing in places; and, as much snow had fallen, we had some trouble in getting along, the newly fallen snow being a great hindrance; but when clear of packs of ice the ship travelled at a great speed. That night we proceeded until after ten o'clock, the ice being illuminated by the electric projector, and the sight from the bridge of this illumination was wonderfully fine as the vessel passed through the ice, a dense fog finally bringing us to a standstill. At times the ship would get into a water-lane, and the effect of the ice at the edges of the canal is most interesting. The sea ice in the Baltic is a bright emerald green, and the lines of cleavage of the ice are well seen in the lanes. Of course the vessel gained great speed in these canals, and the smashing of the ice at the end was grand, the vessel driving large masses of ice apart as she tore through them.

The next morning an early start at 4 A.M. was made, and this day was characterised by the large number of packs we had to pass through; at places the whole face of the ice was a series of packs. The water at

this portion of the Gulf of Finland is, at the time of the forming of the ice, continually on the move, so that as the ice forms it is broken adrift by currents, winds, and the sea, and re-forms in packs mainly in line across the gulf, and therefore across the line of the ship's course, packing in places to 20 and 30 feet in thickness, the packs being above the line of the field from 4 to 7 feet.

On the rocks and islands in the Gulf of Finland the ice forms to an enormous thickness; on some of the islands where the lighthouses are situated, large walls have been built to prevent the ice, by pressure, from overflowing the islands and destroying the dwelling-houses and lighthouses. On this day the ship came amongst the fishermen who live on the ice during the early months of the year; this population numbers from one thousand to twelve hundred persons. They have wooden huts to live in, holding from ten to twenty persons each, and are packed in them at night like "sardines in a box." The roads on the ice through the snow are staked with bushes to guide them during fog and snowstorms. The fishermen collect the fish from the fishing-holes in small hand-sledges, which in turn are brought together in large pony-sledges and taken to St. Petersburg for sale. Often we had to stop to allow a train of sledges to pass, and considerable care is required in navigating the vessel at night not to strike one of the huts, or the small bush-shelters (behind which the hardy little ponies stand with nothing over them in this dreadful climate). These fishermen for the most part are agricultural labourers, who have nothing to do during the winter, and comparatively few of them follow a seafaring life.

The noise occasioned at the bow of the steamer when ice-breaking is in progress is considerable; but such is use, that after the first day it was scarcely noticeable, and the vibration set up in the structure of the bow is very small indeed.

As the ship proceeded up the gulf, the ice gradually changed to fresh-water ice of a bluish tinge, very hard, which broke with a sharp report. The packs were left behind, and the whole surface became smooth. Through this ice the ship passed quickly, and great was the pleasure of all on board when the spires and chimneys of Cronstadt were in view, lit up in the setting sun of as brilliant a day as can be imagined, snow-glasses for the eyes being necessary from the early morning, owing to the brilliancy of the sun. That night the ship stopped a few miles from Tolboukin lighthouse; about 10 P.M. the pilot arrived, having come in his sledge from the pilot station, the first pilot to assist a ship under such strange conditions.

The entrance of the ship into Cronstadt was the occasion of great excitement, especially as up to the time of her arrival in sight of the port it was firmly predicted that the feat was an impossibility. The weather was brilliantly fine, and as we approached the harbour many sledges came to meet us, and a large multitude of people, also a company of a regiment on "ski," making a most picturesque sight. Some hundred men or more who were at work blasting rocks were drawn up in line, and cheered lustily as the ship passed them. The ship could easily break her way through the ice below Cronstadt at eight knots

an hour, the field-ice being from 18 to 24 inches thick, with 6 inches of snow upon it. The entrance into the harbour was deftly managed, and the ship was berthed among a large crowd of persons on the ice without the assistance of even a rope, and Cronstadt with its navies was an open port for the first time in its history.

Three days after the arrival of the *Ermack* at Cronstadt, she was ordered to Reval to save steamers that were in danger of being crushed by the ice, and to open up the harbour. The return, as far as Hogland, was accomplished down the canal that we had broken on the upward voyage, the ship going easily through this at half speed. After passing Hogland, we were very much delayed by fog and snow. The navigation of the Gulf of Finland is difficult at all times, but when covered with ice and fog, navigation in such dangerous waters is indeed troublesome; soundings can only be taken under very great difficulties. Reval Bay was reached the next afternoon: there we found that an enormous ice-pack had been formed across the entrance to the bay, fifteen miles from the town of Reval. The pack had formed during a NW. gale that had blown the drift-ice from the Baltic into the bay, packing it 3½ miles across, about one-third of a mile wide, and from 20 to 25 feet thick, completely closing the harbour. The top of this ice was very rough and difficult to get across. On arriving near this pack we found that the field-ice had eased, leaving a water-lane some 500 feet wide, and through this at about 3 P.M. we steamed at full speed, striking the ice on the other side at fourteen knots an hour. Close to the place where we entered, a steamer (the SS. *Fairhead*) was fast: the concussion of the *Ermack* with the ice liberated the vessel, which came astern into the water-lane, and then followed us up the canal which we were making. By 5 P.M. we were through the large pack, which took some fourteen charges to accomplish, the newly fallen snow being a great obstruction. We immediately liberated the Reval ice-breaker and another steamer that had been fast ten days, and then proceeded down our own canal to liberate three steamers belonging to the Copenhagen Steamship Company that were in great danger near rocks below Sourop lighthouse, one of them without a propeller, a second with only one bade left, and the third (which had come to their assistance) fast close astern of the others. The cutting out of these vessels was a grand sight, as the *Ermack* had to break three large semicircles out of the ice from the water-lane before she could get sufficiently close enough to them to crack the ice up to their hulls: great care had to be exercised that we did not squeeze them and crush in their sides. This operation was carried out after dark under the electric light, all the vessels having ample means of lighting on board, and was indeed a splendid spectacle. The next morning we liberated three more vessels, and then proceeded to take them all up to Reval, breaking a channel as we went. The entrance to the Reval harbour was made the occasion of great rejoicing by the town, and large numbers of people in sledges and on foot came to meet the fleet, making a most exciting scene as we came "tearing" through the crowd at full speed. As there were many steamers in the harbour and others expected, it is easy to understand how the opening

of the port by the *Ermack* was the cause of much pleasure to its inhabitants.

We left Reval early on the Saturday morning before Easter day to search for two steamers that were fast in the ice out in the entrance to the Gulf of Finland, and reported to be in danger. We steamed across through the ice to about twelve miles off the port of Hango in Finland, where the ice-breaker *Sampo* came to meet us, and she gave us the approximate position of the lost steamers. As this was 9 P.M., we steamed through the ice by the aid of the electric projector until it was judged that the distance was run; during the night it came on to blow a heavy gale, with snow falling. At daybreak on Easter Sunday we saw a steamer (which we liberated), but found she had only been fast two days. We then steamed westward, and at last sighted one of the lost steamers. With some careful handling we broke the ice round about her, and steamed off again with this boat following. In half an hour we found the other steamer and liberated her. By this time the gale was blowing strongly, and the ice in this part of the gulf broke up immediately after the second boat was liberated, and but for the timely arrival of the *Ermack*, these boats and every soul would have been lost, as the break-up of the ice would have crushed in their sides. They had been sixteen days fast, and the chart of their drift is very interesting. The crews in both boats were on the verge of starvation.

The *Ermack* shortly afterwards returned to Cronstadt and proceeded to St. Petersburg. During the limited time she was on the station that spring, the *Ermack* was instrumental in salving eighty-two vessels that were fast in the ice.

Arctic Expedition.

The object of the Arctic expedition was to test the capabilities of large ice-breakers amongst the polar ice. The *Ermack* left the Tyne on the 23rd of July 1899 and proceeded to Advent Bay in Ice Fiord, Spitzbergen, there to meet our tender (the ss. *Virgo*) an ice-breaking steamer of small dimensions. She was loaded with coals and other spare things likely to be required. The *Ermack* was fully provisioned for twelve months in case of her becoming fastened in the Arctic ice and being unable to get free until the following summer of 1900. There were altogether 125 souls on board, the larger portion belonging to the engine-room staff. Amongst others were the scientific staff, consisting of hydrologist, meteorologist, astronomer, and artist. The duties of deep-sea sounding were undertaken by the chief officer, and dredging at great depths was superintended by Admiral Makaroff and the head doctor. On the voyage out and home to Advent Bay a complete set of stations were taken, position, depth, materials of the bottom of the ocean, the currents and the temperatures of the water, and other matters all being most carefully recorded. The taking of the temperatures of the ocean at varying depths down to 1600 fathoms being a most interesting study. The stops for each station occupied over two hours. All these objects going forward together gave us much to do. On

arriving at Advent Bay we found not only our tender, but also the small tourist steamer *Lofoten*, from Tromsoë; a large steam yacht, the *Erl King*, and two small Norwegian sealers—making quite a fleet in this far-away corner of the earth. We left Advent Bay on Saturday, August 5th, and on Sunday we encountered the first polar drift-ice at 7.20 A.M., and shortly afterwards we bade adieu to our tender. We were then well amongst the ice, and the fight commenced in real earnest, collisions with enormous masses occurring continually. Where possible the ship was steered so as to push the larger floes aside, but as they became thicker and older as we proceeded north, it was soon a question of ice-breaking and charging all the time.

In speaking of charging it must be understood that the vessel when stopped by ice retires a hundred yards or more, and gets up speed to strike the strong spot, and continues to do so until the obstruction is broken down. The *Ermack* is also designed for charging astern when it is desirable. Of course, when an opening in the ice could be seen, we steered for that place. The reflection of the water is seen in the sky in the Polar regions at a considerable distance, and by this means the vessel can be steered to these places. In some of the water-lanes it is curious to note how the ice had separated in a vertical cleavage, leaving walls of solid ice on each side of the canal from 12 to 20 feet thick: one can see the packed ice below the water-line for a considerable distance. In these translucent waters on a clear day the eyesight reaches down about 40 feet, but when you let the lead down, the ice is found at 80 feet, and even more, showing how the great ice is packed. At times the "floes" are easily broken up, that is, when the ship strikes the ice on the line of cleavage. On other occasions some hard blows are necessary to force a passage, and as the ice is covered with snow it is very difficult to judge a soft place. Generally speaking, a soft place (to all appearances) turned out to be quite the reverse. However, all this time the ship was steadily proceeding north. The object in entering the polar ice immediately to the north of Spitzbergen, instead of further to the eastward as has been customary heretofore with Arctic expeditions, was that should any accident happen to the propellers, the ship would—through time—if disabled, drift out of the ice with the Polar stream to the eastward of Greenland.

The *Ermack* with half boiler power could force her way through polar ice of 12 to 14 feet thickness at 2½ to 3 knots an hour: where the ice was slack, this speed was exceeded.

The first occasion of seeing a polar bear caused much excitement among all hands, rifles and cameras doing great execution. This bear was shot whilst swimming from one floe to another, and from this time we saw many others. A polar bear is not dangerous until wounded, or unless he is very hungry, and even then he prefers to run away if he can It is most interesting to see the mother's care of her cubs: when startled by the ship the she-bear always kept her cub on the side away from the ship. On one occasion a family of three paid a visit, and the cub was first wounded; the desperate attempts of the parents to help this young bear over the ice were most pathetic, but a lucky shot killed the cub; the

she-bear then rounded on the male and punished him most severely, thinking, no doubt, that he was the cause of the death of her cub. This *contretemps* allowed the hunters to come up, and all three bears were secured. The skins of these and others were preserved in barrels, and the flesh, which was generally fat, was salted and preserved for use in some of the first-class restaurants of St. Petersburg, where it is considered a dainty. The heads were boiled until nothing but the skull remained, and are trophies of an interesting and rare character. The cub above mentioned was stuffed, and now is a splendid ornament in the main entrance of the vessel.

A large amount of scientific work was undertaken, among which deep-sea sounding in the Polar ocean, and the taking of temperatures of the atmosphere and water, and samples of sea water at varying depths are the most important. The samples of sea water are obtained by an instrument called a "matometer" (the invention of Admiral Makaroff). It is a metal bottle encased in indiarubber, with automatic valves at the top and bottom. As this is lowered into the sea the water flows through the bottle, but as soon as the downward action ceases, the valves close, and the sample is retained, and as the bottle and valves are insulated by the indiarubber coating, the temperature remains constant until the operator has an opportunity of testing it by the thermometer. The temperature was also taken by automatic deep-sea thermometers, but these are not very reliable owing to their liability to fracture. It is a long and tedious operation sinking the matometer by hand to 1600 fathoms and bringing it up again.

Astronomical observations for the true position of the Meridian had also to be made when the sun condescended to show himself. The astronomer had to go more than a mile from the *Ermack* to be beyond the influence of the magnetic force of the ship. His instruments, a tent to shelter him from the wind, his kettle (a Primus, the same as Nansen used), and rations for himself, and his two guards, were all packed on a sledge which was drawn or carried over the ice in an ice-boat. It was necessary to send two men to keep guard over him, as his observations (if the atmosphere kept clear) extended during the greater part of the day, and the guards had to keep a look-out for bears, fogs, or the parting of the ice-floe. Even the guards had to be fifty yards from the astronomer to prevent magnetic influence from the rifles disturbing the instruments. Simultaneously a "look-out" was kept from the crow's nest at the ship, so that should fog, or snow, or ice-parting occur, all was in readiness for a rescue. The observations of the atmosphere, the force, the wind, direction of the currents, and the drift of the ice, sketching and painting the ice-fields, photography, and recording the pressure and depth of the ice, were an all-absorbing study, to which the whole time of those on board was devoted. The scientific investigation of the ice took up a large amount of time, and 129 samples were tested for specific gravity, salinity, buoyancy, strength, both in compression and tension, melting temperatures and the configuration of the ice; this latter is a great problem, as the formation of the ice is of so many different descriptions, and no doubt the surrounding conditions affect it

in a very great degree. Masses weighing five tons were brought on board for investigation; the refreezing of the ice that had been melted produced some very pleasing results. When time allowed, snow-shoeing was much indulged in, most of us coming croppers at the commencement; going for walks and climbing the hummocks, shooting bears and seals were other sources of exercise.

The divers were sent down occasionally to see that all was well below the water-level, and great care and attention had to be given at these times, for should the ice close tightly to the vessel the diver would have lost his life.

Of animal life, at high latitudes, the polar bear is most common, then seals, walrus, and narphals, and we have even seen a shark: he came after a bait we had out, but missed it, and whilst turned over on his back the hunter (Permikoff) jabbed a boat-hook into him, and rushed him on to the ice, where he was secured. This specimen was 7 feet long, and had a splendid mouth of three rows of teeth, top and bottom. His flesh was excellent eating. Of birds, as soon as we passed through the drift to the solid ice, we left all the various divers behind, and only the large grey gull, the ivory gulls, and the little auk remained. This interesting little bird was with us at all times, and his shrill cry sounds very weird in these lonely and quiet regions. The only other bird far north was the beautiful ivory gull, spotless white, with a yellow beak and black legs. He is easily shot, as, having never seen human beings, he fearlessly approaches the vessel. We have seen these gulls following the ship when under way, and gorging themselves on a small fish that lies near the surface, and as the ice is disturbed he can feed on these until he can eat no more.

A keen look-out was kept for "Ross's gull," but we were never fortunate enough to see one.

The sight from the bow and bridge of the *Ermack* when she is forcing her way through the ice is at all times remarkable, and so fascinating that one is quite unable to tear oneself away from watching the scene of the moving floes pressing on one another, turning edge upwards, the destruction of the hummocky ice, the rip of the solid ice when the ship breaks it, and the yawning blue chasm that forms as far down as the keel until the ice opens at the bottom of the fracture, and the sea rushes up.

At times it was necessary to push the large floes apart: in such cases the *Ermack* was put at a spot where we thought the floes would part, and then after some minutes of pushing, we would notice one floe beginning to move from the other. On occasions we have seen these floes of great size: in the Paleocristic ice we very seldom saw a floe less than 500 tons in weight, and amongst this class of ice considerable judgment had to be exercised in handling the vessel. On this ice it is easy to examine the propellers when standing on the edge owing to the transparency of the sea. Large ponds, or lakes, of fresh water melted from the snow and frozen over are met with in many places, sometimes a number of them with canals in the ice from one to another. When the sun shines melting soon commences, and large masses of water

collect on the ice. We pumped a great deal of fresh water into the tanks of the vessel from these ponds for the use of the boilers and washing purposes. A fresh-water lake and ice were always of the brightest and deepest ultramarine blue, but a lake or pond that had a communication with sea water was emerald green. The packs of ice are at times of very large dimensions: we have met them 25 feet high above the field in places, in some packs even more.

Some very good cinematograph pictures were taken, and when shown they give a very graphic idea of the ship charging amongst the ice, and the manner in which it is tumbled and pushed about by the vessel. Occasionally a large piece of ice would come up from below and strike the *Ermack*, making the ship shake.

We met icebergs, but one does not visit icebergs too closely with a steamer owing to the extreme hardness of the ice and other dangers. On one of them where we landed there were large remains of the "Moraine," and some specimens were brought away for geological research. Some of the icebergs were of enormous size, standing up like mountains two hundred feet high—to all appearance like islands amongst the ice.

The time came when, owing to the freezing of the new ice going on continuously, and the ship being some 200 miles into the polar ice, and the absolute necessity of getting south in time for the *Ermack* to return to her station in the Baltic, the ship's head was turned homewards, and then commenced our greatest struggle, as the ice had closed tightly around us, and it was a long continuous fight to the clear water. At times we have been charging and hammering at floes of rough packed ice of enormous hummocks for one or two hours before breaking down the obstruction, and having almost to retrace our course to get round some hummock of large dimensions.

During this time it was bitterly cold, and the snow accompanied by wind made the atmosphere far from pleasant. The ice pressure appears to be more affected by wind than other causes, such as currents. No doubt land—even at a great distance—and the rise and fall of the tides, especially the spring tides, have much to do with these pressures, but patience is always rewarded in course of time by an easing of the ice, and at times the pressure must have been gigantic to result in the enormous packs and rough ice observed.

After leaving the ice the ship proceeded to Advent Bay, as this was our rendezvous, and we had to advise our tender of our return. The climate had changed much during our absence, and winter was upon us. In Advent Bay we found the large yacht *Princesse Alice*, belonging to His Highness the Prince of Monaco; visits were exchanged, and as the Prince is much interested in oceanic study and problems, his yacht is fitted out in a very scientific manner. He had been cruising on the ice edge to the north of Spitzbergen during the summer months.

Advent Bay, situated 22½ miles from the entrance to "Ice Fiord," is a most desolate spot surrounded by mountains, whose heads are nearly always in the clouds, but when the sun shines the scenery is truly magnificent. There is absolutely nothing green, as the island and the valleys are filled with huge glaciers, but coal of fair quality is

plentiful in "Ice Fiord," the seams coming to the water's edge; the Norwegian sealers often call here to fill up with it. There is very little game, as the reindeer has been nearly shot out. The fishing is poor, and the blue and white fox are very scarce. Gulls and sea-birds abound during the short summer. On the rubbly spit of land at the entrance to the bay is seen the small cemetery where those who have died far from home are buried, and the remains of two huts that have in years past sheltered shipwrecked crews who have had to pass the winter in this scene of desolation. The intense stillness of the spot seems almost to numb one's senses, and produces a peculiarly restful feeling of the body and nervous system.

Our stay here was short, and after a very stormy passage, we were, I believe, all glad to be once more inside the Tyne, and feel that no accident had happened, and that all who left with the ship had returned safely.

THE RIVER SPEY.

By LIONEL W. HINXMAN, B.A., of H.M. Geological Survey.

THE physiography and geological history of the river Spey present several points of interest which, as far as I am aware, have not been discussed by previous writers on the Physical Geography of Scotland.

It is unnecessary in the case of so well-known a river as the Spey to enter into any geographical details as to watershed and course that can be followed on any good map. It will be sufficient to state that the drainage basin of the river—that is, the area from which it derives its waters and the rock-waste which it carries to the sea—is approximately 1300 square miles in extent. The upper portion of the basin includes a wide tract of high mountainous ground, that in its greatest breadth measures 25 miles from north to south. The length of the river, measured along its windings from Loch Spey to the sea, is 97 miles, or almost exactly that of the Tweed.

On looking at a map of the drainage basin of the Spey one is at once struck by the fact that the river does not occupy the centre of the area, but lies considerably nearer to the northern than to the southern boundary. It will also be noticed that the southern tributaries are more numerous and important than those flowing in on the northern bank, and that the former have a course more or less at right angles to the main stream. The only northern tributaries of any size, the Dulnan and Calder, flow for the greater part of their course through longitudinal valleys, parallel to that of the Spey. The southern side of the basin includes a large extent of mountainous country, most of which has a greater mean elevation than the ground north of the river. This implies a greater fall for the streams flowing in from the south, as well as a greater rainfall. Hence they have been able to cut a long way back into the original high-level plateau, and thus drain a larger area than those on the north side.

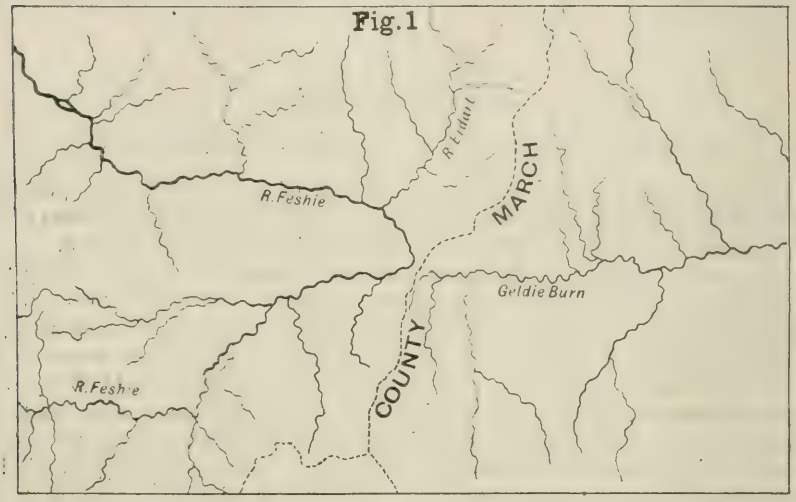
The upper course of the Feshie, one of the largest tributaries of the

Spey, presents an excellent example of the shifting of a watershed, and the capture of the head-waters of a stream belonging to another river-system.

For the first six miles of its course the Feshie flows to the east, but at the point where it touches the boundary between the counties of Aberdeen and Inverness, it bends suddenly round, and runs in a directly opposite direction on the further side of Sron na Ban Righ. The watershed at this bend is only a few feet above the bed of the stream, and on the eastern side a wide peat-filled valley, now only occupied by an insignificant burn, runs eastward to the Geldie, following the same line as the course of the Feshie above the bend.

It is evident that the river Eidart, which joins the Feshie a mile below the bend, was once the head-stream of that river, but that the Feshie has gradually cut back its bed to the county march and captured

Fig. 1



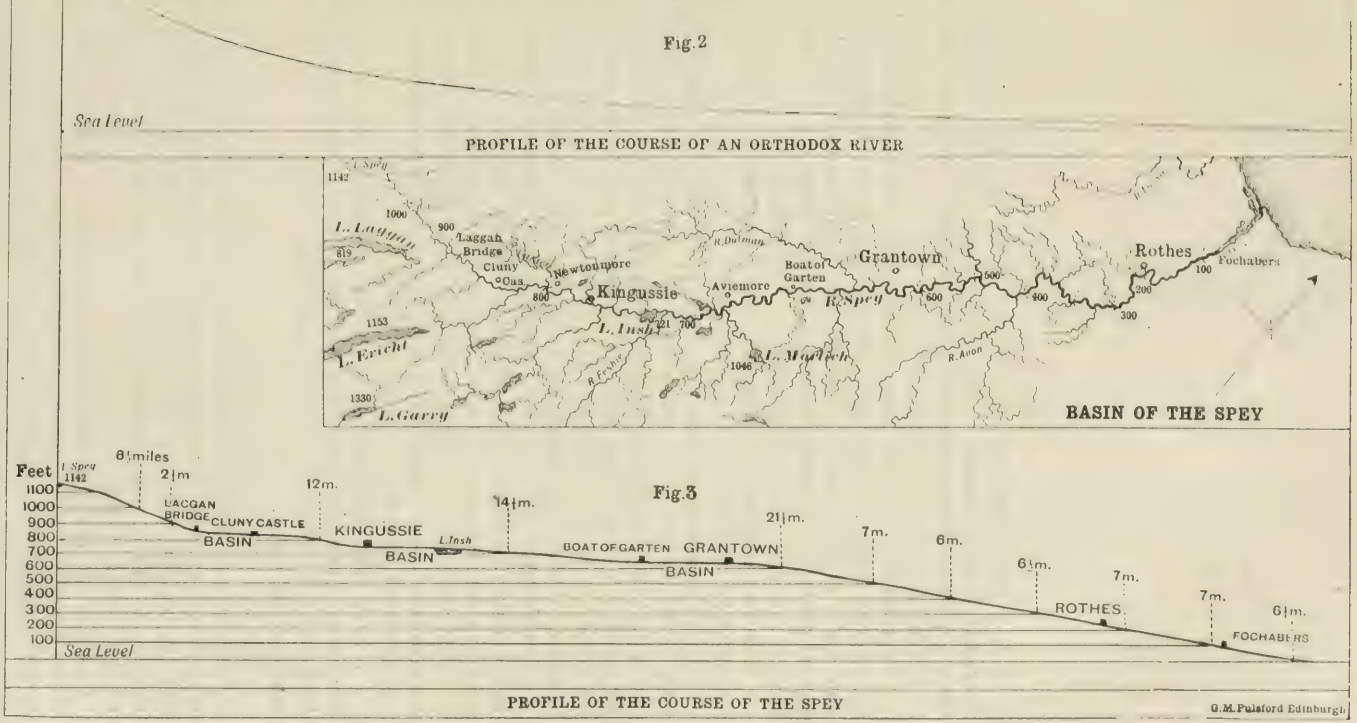
the upper part of the Geldie. Thus the former head-waters of the Geldie are now those of the Feshie, and the watershed between the basins of the Spey and the Dee has been shifted more than six miles to the eastwards.

It is a common belief that the Spey is the swiftest river in Scotland. But this statement, which will be found in almost every school geography and guide-book, is not according to the facts. The total fall of the Spey, from source to mouth, is 1142 feet, and less than that of either the Dee or Tay; and is, moreover, very unequally distributed over its course. The lower portion is certainly swifter than that of either of the above two rivers; but a large section of its middle course is comparatively slow, and in places even sluggish in character.

The large rivers of north-eastern Scotland have also been recently described as orthodox in their course—that is, as exhibiting the three regular phases of upper or torrential track, middle or valley track, and lower or plain track.

That this is not the case with the Spey will, I think, appear from a consideration of the following facts:—

Fig.2


Sea Level
PROFILE OF THE COURSE OF AN ORTHODOX RIVER
L. Spey
1142
1000
900
L. Laggan
819
Laggan Bridge
Cluny
Newtonmore
Clua
800
Kingussie
Aviemore
R. Dulnan
Boat of Garten
Grantown
R. Spey
500
600
400
300
Rothes
100
Fochabers
1153
L. Ericht
L. Insh
721
700
R. Truim
1046
L. Morlich
R. Avon
1330
L. Garry
BASIN OF THE SPEY
Feet
1100
1000
900
800
700
600
500
400
300
200
100
L. Spey 1142
6½miles
2½m
12m.
14½m.
21½m.
7m.
6m.
6½m.
7m.
7m.
6½m.
LAGGAN BRIDGE
CLUNY CASTLE
BASIN
KINGUSSIE
L. Insh
BASIN
BOAT OF GARTEN
GRANTOWN
BASIN
ROTHES
FOCHABERS
Sea Level
Fig.3
PROFILE OF THE COURSE OF THE SPEY
G.M. Pulsford Edinburgh

PROFILE OF THE COURSE OF THE SPEY

FALL OF THE SPEY.

Feet.		Feet.		Miles.
From 1142	to	1000	in	6½
,, 1000	,,	900	,,	2¼
,, 900	,,	800	,,	12
,, 800	,,	700	,,	14¼
,, 700	,,	600	,,	21¾
,, 600	,,	500	,,	7
,, 500	,,	400	,,	6
,, 400	,,	300	,,	6½
,, 300	,,	200	,,	7
,, 200	,,	100	,,	7
,, 100	,,	Sea-level	,,	6¼

Fig. 3 represents a vertical section or profile of the course of the Spey, and it will be seen at once how much this line departs from the smooth parabolic curve shown in Fig. 2, which represents the course of an orthodox and mature river.

The profile-line of the Spey is divided into three well-marked sections of unequal length. The upper section has a fairly steep but uneven slope; the middle section is gently inclined throughout, and at three several points is for some distance almost horizontal; the lower section falls steeply and evenly to the sea.

A closer examination of the levels at various points serves to emphasise these three divisions.

In the first part of its course, from Loch Spey to Laggan Bridge, the Spey falls 327 feet in 14 miles, or at the rate of 23 feet per mile. In the middle portion, between Laggan Bridge and Grantown, 215 feet in 40 miles, or 5·3 feet per mile. From Grantown to the sea, 600 feet in 43 miles, or at the rate of 14 feet per mile. The fall per mile in the lowest section is thus nearly three times as great as in the middle section. Nor is this large fall due to any sudden steep descent or series of rapids. It is evenly distributed over the whole distance of 43 miles (as will be seen by a reference to the table), and represents a slope of about 1 in 378.

Before seeking for an explanation of this striking departure from the normal, it will be advisable to return to the higher parts of the river, and examine its course in greater detail.

I have said that the middle section contains three nearly horizontal portions. These indicate the position of three basins formerly occupied by lakes, but now drained by the gradual lowering of the barriers which retained the water.

The first of these basins extends from near Dalcholly, above Laggan Bridge, to a point a quarter of a mile above the confluence of the Truim with the Spey, and forms an alluvial flat six miles in length, with an average breadth of half a mile. Through this flat the river winds with a sinuous course, cutting deeply into the sand and fine silt which at an earlier period it laid down on the floor of the loch. The numerous "cut-offs" or curving pools, such as the Sean Amar (Old Channel), above Laggan Bridge, show the method in which the river is always straightening its course, by cutting through the necks of the loops as it winds from side to side of the valley. The barrier which produced this

basin is found a short distance above the mouth of the Truim, where the rocks of Torr na Truime and of Creag Dubh approach one another on either side of the valley.

The next basin extends from Kingussie to the foot of Loch Insh, which represents but a small remnant of the ancient lake whose waters covered an area seven miles in length and nearly a mile in breadth. The barrier of the Kingussie basin is not so obvious as that of Invertruim; and in this case there is no constriction of the valley. An explanation must be sought in the river Feshie, which flows at right angles into the Spey, a short distance below Loch Insh. This river, which drains a wide area of high mountain ground, and flows with a rapid fall through a steep-sided valley, carries down a vast amount of rock-waste, which is spread out in a large alluvial fan between Feshie Bridge and the foot of Loch Insh. In times of heavy spate the tributary will bring down more coarse material than the main river can carry away; the fan of alluvium grows and pushes the latter against the further side of the valley, and has undercut the steep northern bank below Kincraig. A further increase in the alluvial deposit of the Feshie at an earlier period may have partially held up the waters of the Spey, and caused them to spread out in a shallow lake above the fan, for even at the present time it is a common sight to see timber, brought down by the flooded Feshie, floating *up* the Spey towards Loch Insh.

Large sums have been expended in protecting the meadows of Insh and Kingussie by embankments that are destroyed by every exceptional flood, while the same money devoted to causing the Feshie to flow with an oblique course into the Spey half a mile further down, and to deepening the Spey channel below the island at Kincraig, would drain the upper part of Loch Insh, and convert the marshy meadows above, that are now flooded for half the year, into fertile, arable land.

The wide stretch of alluvium that extends for about three miles above and below Nethy Bridge points to the existence of two former lake-basins, the one between Gartenmore and Broomhill, the other between Broomhill and Balliefurth. A damming-back action of the Nethy, similar to that ascribed to the Feshie, may possibly account for the upper basin; while there are indications of a rock-barrier at Revack Hill that may have held back the waters of the lower loch.

But in addition to these ancient lakes, whose position and extent can be estimated with tolerable accuracy, we are confronted with the fact that nearly the whole of the middle section of the course of the Spey is a waste-filled basin.

Between a point two miles above Kingussie and Grantown, no rock is seen in place anywhere along the river-bed. Throughout the whole of this distance of twenty-seven miles, the river is now engaged in cutting through a flood-plain composed of the materials deposited at former periods, when the amount of waste brought down by the Spey and its upper tributaries was greater than the river below could carry away.

It has already been said that the last forty miles of the Spey present a steep and regular slope. Over the greater part of this distance the river is flowing through solid rock, and is still engaged in deepening its bed.

So great a departure from the normal course of a large river indicates that this portion of the Spey is of more recent origin than the middle section above Grantown, where it has long ceased to deepen its original bed, while the fact that the river is still cutting back also shows that the slope between Grantown and the sea must have been increased at some period later than that of the excavation of the upper part of its course.

The effect of an uplift or elevation of the land along an axis running north and south somewhere about Grantown would be to diminish the slope of the river valley on the upper or south side of the axis, and to increase the slope below, and such an uplift may therefore be suggested as the possible cause of both the long waste-filled basin above Grantown, and the rapid fall between that place and the sea.

In the first case the decrease in slope would diminish the transporting power of the stream, and the waste material would accumulate until the basin became filled up. Below the axis of upheaval, on the other hand, the increase in slope would enable the river to do an increased amount of work. It would therefore cut back its bed afresh, until the outlet of the flood-plain above was lowered, and the materials, temporarily arrested in their course, resumed their journey to the sea.

The alluvial deposits in the upper part of the basin appear to be of great thickness, and it is possible that this part of the valley may have been deepened by the action of glacier ice. It is certain that much of the alluvium is fluvio-glacial—that is, it has been laid down by water flowing from melting ice-sheets. This point will be referred to later on.

The lowest rock-barrier on the Spey is found in the well-marked constriction of the valley at the Pass of Sourden below Rothes. The quartzite of Ben Aigan here formed a barrier that dammed back the water over what is now the fertile Haugh of Rothes, and the remains of this barrier can still be seen on either side of the river at Aikenway Castle. There are indications that the Sourden barrier was at one time high enough to divert the waters of the Spey through the Glen of Rothes. This glen is flanked on either side by well-marked successive terraces that can be traced southwards by Blackhall and Newton, and merge into the high-level terraces of the Spey between Rothes and Craigellachie. The highest of these is nearly 500 feet above sea-level, and may be correlated with the extensive terraces at Knockando and Phones, higher up the river. They are composed of sand and very fine gravel, which was laid down at a time when the gradient of the river-bed was much less steep than it is at present.

The fall of the Spey over the last few miles of its course is at the rate of 16 feet per mile, and so steep is the slope, that the highest spring-tides do not flow further than half a mile above Speymouth. This rapid fall, so unusual near the mouth of a large river, is probably due to the movement which raised the coast-line some 100 feet above the present sea-level, and laid bare the high-level marine terraces that fringe the coasts of the Moray Firth. The old shore-line can still be traced in the low cliffs of red sandstone that are seen above and below the bridge at Fochabers.

Below this point the river is now cutting rapidly back through the loose shingle deposits of the 100-foot and 50-foot raised beaches. These beaches are more or less covered by the alluvium laid down by the river when it first began to flow over the newly raised surface. This portion of its course is consequently very erratic, and the river has at one time or another flowed over the whole of the wide alluvial plain that extends both westwards and for two miles eastwards over the muir of Dallachy. It has now cut down below the surface of this plain, and flows to the sea through a lower tract of recent alluvium in a wilderness of branching channels that shift with every flood. The actual mouth of the river has also changed its position frequently within recent times, and there is evidence to show that it is now travelling westwards.

The site of a Roman station can still be traced on the east side of the river one and a half miles below Gordon Castle. The camp stands on the edge of the 100-foot terrace looking over a lower alluvial plain; and though there is no direct evidence of any recent depression of the coast-line sufficient to cover this plain with the waters of the sea, we may speculate as to the possible existence of an estuary, the *Tuessis Æstuarium* of Ptolemy, up which the Roman galleys sailed to a port which perhaps occupied the present position of the village of Fochabers.

To conclude with a short account of the geological history of the basin of the Spey.

We know that the courses of many of the rivers of the west coast are not earlier than Miocene times, and the actual channel of the Spey may have undergone many local changes within a comparatively recent geological period. But the valleys through which the river and its principal tributaries flow belong to a very early period in the history of the earth. That they existed before the Old Red Sandstone age we know from the fact that the river Avon at Tomintoul is still cutting down through an outlying patch of the conglomerate of that formation which is filling up the ancient valley. How far this formation extended up the Spey valley we cannot say, but the occurrence of conglomerate in the Findhorn valley at a height of 1100 feet above the sea, points to a wide extension westward of Old Red Sandstone strata.

The rocks throughout the greater part of the Spey valley belong to the Highland Metamorphic series, including different varieties of crystalline schists, gneisses, and quartzites. The age of these rocks is still an open question, but we are safe in assuming them to be of at least Pre-Silurian age, while they may very possibly be found eventually to belong to the Torridonian or some other formation earlier even than the Cambrian period.

Between Boat of Bridge and Fochabers the river is still cutting through the sandstones and conglomerate of the Old Red Sandstone.

It is possible that certain of the great structural lines of the central Highlands have played some part in the history of the Spey valley. The fault which crosses the Moor of Rannoch and determines the hollows in which lie Loch Laidon and Loch Ericht, is continued down the valley of the Truim and passes into that of the Spey. Its subsequent course is concealed beneath the alluvial deposits, and there is no further

evidence of any dislocation of the rocks; but it is not unlikely that this fault may have to some degree determined the line of the valley at this point. The course of the valley between Craigellachie and Rothes coincides with the line of another fault which runs through the Glen of Rothes and Glen Fiddich, and has shattered and brecciated the quartzite of Beinn Aigan along the river bank at Arndilly.

It may seem a "far cry" from Strathspey to the parallel roads of Glen Roy, yet the conditions which produced these well-known features were at the same time the cause of an important phase in the history of our river.

The terraces of Glen Roy and Glen Spean are now admitted by all competent observers to be ancient lake margins. They mark the successive levels of the water dammed back in these glens by masses of glacier ice moving eastwards from the high mountainous ground around Loch Eil. Three of these distinct terraces can be traced along the sides of Glen Roy, and one at least in Glen Spean. The mean levels of the Glen Roy lakes, as shown by these margins, were respectively 1148, 1067, and 855 feet above the sea—that of the Glen Spean lake, 855 feet, corresponding with the lowest of the Glen Roy terraces. The col, or lowest point of the watershed between the head of Glen Roy and Loch Spey, is 1151 feet above sea-level, while the highest level reached by the highest terrace is 1155 feet. It follows that the waters of the lake corresponding to this terrace, when at their fullest, must have escaped over the col and flowed down into the Spey. It has been objected to this theory that there is no sign of any large body of water flowing eastwards over this col. To this objection we may reply that even at its highest level the lake would only stand four feet above the level of the col, and that the normal outflow would not amount to more than a mere "seiping" through the flat peaty hollow that here crosses the watershed. The drainage and surface areas of this loch were also comparatively small.

All who have taken the charming drive from Kingussie to Loch Laggan will remember the straight level valley through which the road passes between the Mashie Water and the sudden eastward bend of the river Pattack. There can be little doubt that this peaty hollow indicates the channel through which much of the water that now flows westwards into the Atlantic once poured eastwards to swell the volume of the Spey.

The watershed of Scotland crosses the road immediately east of the bend of the Pattack. The height of the col is 848 feet, that is, seven feet lower than the mean height of the terraces corresponding to the Glen Spean and lowest Glen Roy lakes. The drainage area of these lakes must have been very extensive, and their combined waters would form a narrow loch twenty miles in length, but with an average breadth not exceeding one mile. A considerable volume of water must consequently have flowed eastwards down Strath Mashie to the Spey; and in this case there is ample evidence of the position of the old river channel.

There are other features in the valley of the Spey that may be attributed to the later phases of the Glacial Period.

Among these are the high-level terraces so noticeable from the

railway between Glen Truim and Kingussie. They can be traced more or less continuously on either side of the valley from Etteridge and Creag Dhu to Nethy Bridge and Broomhill. Examination of their levels at various points proves that, while they have a slight general inclination down the valley, this is by no means uniform. They are therefore neither ordinary river-terraces, which would slope uniformly; nor lake-margins, that would be horizontal. It seems more probable that they were formed by the deposition of sand and gravel between the edge of a shrinking glacier that occupied the centre of the valley and the hill-sides. The material would be brought down by the streams flowing off the hill-slopes and down the surface of the glacier itself.

The hills around the sources and upper course of the Spey are much lower than the Cairngorm mountains, from which the Feshie and other important tributaries descend. Hence towards the close of the Glacial period, when the ice in Badenoch was dwindling or had even entirely vanished, a large glacier may still have been pouring down Glen Feshie into the Spey valley. This would act as a barrier, or even perhaps send a tongue of ice up the valley towards Kingussie; even as in later times the alluvial fan of the Feshie has partially dammed back the water of Loch Insh. Below Aviemore the high-level gravels stretch completely across the valley and form the flat moorlands around Boat of Garten. This sheet of gravel, together with the thick deposits of similar nature that fill the wide valley of Glen More and cover a large area in the Abernethy forest, are fluvio-glacial in their origin and have been laid down by the great body of water issuing from the melting glaciers of Strathspey as the ice retreated up the side glens and main valley.

The large masses of granite that are seen in the bed of the river at various points between Pityoulish and Boat of Garten, and also occur imbedded in the sand in the cuttings on the Carrbridge railway, further indicate the glacial origin of these sands and gravels. They are far too large to have been brought down by the stream, and have dropped to their present position by the force of gravity, as the glacial deposits in which they were imbedded were washed away.[1]

To sum up the conclusions at which we have arrived from the consideration of the facts described in this paper. The Spey is a compound river, composed of two sections of different age and at unequal stages of erosion. The lower section has been rejuvenated by uplift, and, contrary to the normal conditions of an orthodox stream, is at once younger in age and steeper in gradient than the higher portions. The Spey valley for the greater part of its extent may, on the other hand, be regarded as the result of the slow erosion of the river, continued since early Palæozoic times, along a line determined in the first place by some original irregularity of surface, but subsequently modified to some degree by earth movements and glacial action.

[1] See *Annual Summary of the Progress of the Geological Survey for 1897*, pp. 148-150.

THE BRITISH RAINFALL ORGANISATION.

THE nature and work of the British Rainfall Organisation are so often misunderstood that it may be well to explain briefly the origin and growth of the most elaborate machinery which has ever been brought into action by private enterprise in this or any other country for the purpose of investigating a branch of physical geography.

The late Mr. G. J. Symons, F.R.S., turned his attention to the study of rainfall in 1858 when only twenty years of age; in 1860 he collected all the complete records of rainfall for the year in England and Wales, 168 in number, and published them as a four-page quarto pamphlet entitled *English Rainfall*, 1860. In the following year he collected 500 observations from all parts of the British Islands: and the publication appeared then, and has appeared annually ever since, under the title of *British Rainfall*, gradually increasing to an octavo volume of over 300 pages, detailing and discussing observations at 3500 stations, and publishing important memoirs on various branches of rainfall work. When Mr. Symons began his work there were no definite rules for rainfall study; rain-gauges were of all shapes and sizes, sunk into the ground or perched at any height on poles or walls or roofs, and the records were often conflicting and bewildering: there was no definition commonly accepted of a rainy day, or a drought, and every meteorological authority held his own views as the only standards. These things are changed now, and although perfect uniformity is not yet secured, the deviations have been much reduced.

Mr. Symons succeeded in developing his organisation by enlisting the services of amateur observers in all parts of the country, and he succeeded also in the more delicate task of securing the friendly co-operation of the Meteorological Societies in London and Edinburgh, and of the Meteorological Office, without in any way trenching on their fields of work. The British Association not only approved the labours of Mr. Symons by appointing a rainfall committee of which he was the active member, but for many years contributed to the expense of obtaining and discussing the records. As time went on, some of the more enthusiastic observers, whose means were in proportion to their scientific zeal, associated themselves with Mr. Symons in bearing the heavy expense of the work; so that it became, if not altogether self-supporting, at least a matter of no serious anxiety to its founder, who early obtained a deserved reputation as the leading English authority on rain and its effects.

When Mr. Symons died on March 10, 1900, the Organisation was carried on at his request by his colleague, Mr. H. Sowerby Wallis, who for nearly thirty years had been associated with the work to an annually increasing degree. Finding the task too heavy for one man, and being anxious to secure the unbroken continuity of the system, Mr. Wallis invited Dr. H. R. Mill to share the responsibility, and the work has been carried on jointly since January 1, 1901.

It is the aim of the Rainfall Organisation to bring together and to publish annually on a uniform plan every complete record of the previous year's rainfall which has been taken in the British Islands. Most of

these records are sent direct to the headquarters of the Organisation, 62 Camden Square, London, N.W., by the observers; others are obtained from printed returns, the sources being acknowledged in every case. For most parts of England there are sufficient rain-gauges fairly uniformly distributed to give a good approximation to the annual rainfall of the country; Scotland is by no means so well represented, especially in the Highlands; and Ireland is in a still less satisfactory condition. There is room in all three kingdoms for more observations to be made. Observers often require to be urged to keep up old records as well as to establish new stations. Full particulars of the nature of the work required and instructions for making the observations can always be had on application to the office of the Organisation.

When the observations have been received, examined, the addition verified, the totals corrected (after consultation with the observer if necessary), and the whole mass of figures printed in the annual volume, the raw material is in a state for the commencement of its scientific study. Important investigations on the peculiarities of the rainfall in different districts, and the examination of many new instruments and methods, have been carried out at Camden Square. The geographical aspects of the work still demand a great deal of study, and we may hope that since a well-known geographer has associated himself with the work, this part of it will receive the attention it deserves.

The British Rainfall Organisation is national in its scope, although without endowment of any kind, and unaided by public funds or by the support of any formally constituted society. The value of the results cannot be doubted; and as the development of the water-power of this country is rendered necessary by the increased use of electricity generated by some cheaper agency than coal, the self-sacrificing efforts of Mr. Symons in the early days when he struggled to ensure uniformity and continuity in rainfall observations will be more and more fully appreciated.

Symons's Meteorological Magazine, now edited by Dr. Mill, is devoted to the whole science of meteorology, and has achieved the distinction attained by no other journal dealing with meteorology in the English language, of completing its thirty-fifth year. It grew out of a *Monthly Rain Circular* started by Mr. Symons in order to bring the facts regarding rainfall before the public at the earliest possible date; and tables of rainfall at 150 stations in the British Islands still appear monthly. The newest facts and theories regarding weather and climate are discussed in a popular way, and reviews of meteorological works form a special feature in the *Magazine*.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in March.

Mr. J. E. S. Moore addressed the Glasgow Branch, on the 1st March, on "Some Unknown Countries north of Tanganyika and the Mountains of the Moon." The Chair was taken by Sir John Neilson Cuthbertson.

Mr. Alexander Hosie, British Consul at Newchwang, addressed the Aberdeen Branch on the 4th March. His subject was "Manchuria." The Chair was taken by the Earl of Aberdeen.

Mr. Arthur Gulston, Chief Superintendent Engineer of the Elswick Shipyard, Newcastle-on-Tyne, addressed the Dundee Branch, on the 6th March, on the "Baltic and Arctic Voyages of the Ice-breaker *Ermack* in 1899." Mr. Henry G. Gourlay presided.

Mr. Gulston addressed a Meeting of the Society in Edinburgh on the 7th March, when the President, Sir John Murray, K.C.B., occupied the Chair.

Meeting of Council.

At a Meeting of Council held on the 20th March the following new Members were elected, viz. :—

Hosea Moir.
Fred. Taysen.

The following gentlemen were appointed Corresponding Members, viz. :—

Dr. Boner, *British Central Africa.*
Dr. Chisholm, *British Central Africa.*
Dr. Prentice, *British Central Africa.*

Dr. James Burgess and Mr. Ralph Richardson were appointed to act as the Society's Delegates at the Glasgow University Ninth Jubilee Celebration in June.

Mr. W. L. Calderwood was appointed a Member of the Society's Council.

Meetings arranged for April.

Major Medley, 17th Bengal Lancers, will address the Society as follows, on his Journey from India to England *via* Central Asia and Siberia: viz., in Edinburgh on April 4; in Dundee on April 5; and in Glasgow on April 11.

GEOGRAPHICAL NOTES.

EUROPE.

The Italian Geographical Society elected Sir John Murray, K.C.B. (President R.S.G.S.), an honorary member at a general meeting held on the 24th February 1901.

The Sandstorm in Capri.—We have received the following letter from Mr. A. Silva White :—

"On Sunday last, the 10th inst., there occurred here a phenomenon that may be worth a few words of description in the *Magazine*.

"For a few days previously we had been experiencing strong south-westerly

winds. On Sunday morning the wind was south, and light. It was a true scirocco, hot and moist. But up to windward there was, quite early (when I first looked out), a dense bank of yellow vapour, which soon spread over the sky. I at once recognised this as wind-blown sand-particles from the Sahara. Never before (according to local intelligence) has this been seen in the island of Capri, though in Sicily it is, I believe, not unknown. The sand-clouds hung dark and lowering overhead, and, when of less density, the light beyond gave the clouds a very lurid and weird appearance. At times the whole sky was overcast with driving vapour, heavily charged with sand. It then reminded me of the many sandstorms I have experienced in the Libyan desert, Egypt, and the Sudan, except, of course, that the sandstorm was high overhead. A very heavy southerly sea (ground-swell) was running.

"At nightfall, with a lowering of temperature, there was a heavy precipitation. Rain and sand then fell together, and covered the whole island with a light deposit. My house, which is exposed (being situated on a cliff at the extreme south point of the island) was, the next morning (when the rain had ceased) covered with sand. The sand was almost thick enough to obliterate the pattern (black and white check) of the tesselated balconies.

"In Naples, to the north of Capri, there was quite a panic; the people thought the world was coming to an end, and brought out the Host and their patron saint.

"There must have been a very heavy storm last week in the great desert of North Africa, although it is rather early in the year for bad Khamsins.

"Villa Mercedes, Isola di Capri, Italy,
12*th March* 1901."

The Launch of the "Discovery" took place at Dundee on March 21, the vessel being named by Lady Markham. This ship is the sixth of her name among those which are famous in the annals of British exploration.

The first of her predecessors was engaged in Arctic exploration for some fourteen years—1602-16. She made altogether six voyages, including that of Hudson to Baffin Bay. The second *Discovery* made a voyage to Hudson's Bay in 1719. The third of the name had a great record, being the second ship in Cook's third voyage (1776-80). The ship in which Vancouver carried on his explorations (1791-95) also bore this name, as did the second ship in the great Arctic expedition under Sir George Nares (1875-76), the last important enterprise of the kind carried out at the expense of the British Government.

The new *Discovery* is the first ship ever built in this country for the express purpose of exploration. The ribs are made of English oak, well seasoned, and are placed as close as they could well be without actual contact. These ribs are covered by two skins of oak and of greenheart. Inside, these are lined to the thickness of one and a half inches by asbestos plates, and these again are covered by matchboard. The beams are such as to resist the side pressures to which the ship may be subjected among the Antarctic ice. The deck beams in the living rooms are covered with soft, plain felt half an inch thick. The material and construction of every part of the ship have been provided for by Mr. W. E. Smith, chief constructor to the Admiralty, who drew up the specifications. There is a great sheer in the bow, for the purpose of enabling the ship to make her way through the ice, and her bow will be cased in steel plates. Special arrangements have been made for unshipping the rudder mechanically. Her engines will be of 450 horse-power, capable of steaming about eight knots. An unusually large space has been allotted to the engine-room, by means of which, among other advantages,

a considerable saving of coal will be secured. The vessel will be rigged as a barque. The *Discovery*, at the water-line, is 172 feet in length, with an extreme breadth of 33 feet: her mean draught is 16 feet, and her displacement 1750 tons.

Ordnance Survey of Scotland.—The following publications were issued during February of this year:—Parish Maps, Scale 1 : 2500 (Price 3s. each). *Aberdeenshire.*—Auchterless, XXXVI. 1; Cruden, XXIII. 13; XXXI. 6, 8; XXXII. 5, (6 and 7); XL. 1: Culsalmond, XXXV. 6, 7, 10, 11, 12, 14; Drumblade, XXXV. 5; Ellon, XXX. 3, 4; Forgue, XXXV. 5, 6; Fyvie, XXIX. 6, 7, 9, 13; XXXVI. 1, 2, 3, 4; Gartly, XXXIV. 6, 7, 10, 14; Insch, XXXV. 5, 6, 9, 10, 14; Kennethmont, XXXIV. 10, 14; Longside, XXII. 6, 8, 9, 11, 14, 15, 16; XXIII. 5, 13; XXXI. 6; Methlick, XXIX. 6, 7, 8, 12, 13; XXX. 1; Monquhitter, XXIX. 7; New Deer, XXX. 1, 2, 3; Old Deer, XXII. 9, 13, 14; XXX. 2, 3, 4; XXXI. 1, 6; Peterhead, XXII. 8, 16; XXIII. 5, 9, 10, 13, 14; Rayne, XXXV. 12; XXXVI. 1; Rhynie, XXIV. 10, 14. *Inverness-shire.*—Kilmallie, CL. 3; Kilmonivaig, CL. 3. *Perthshire.*—Ardoch, CXVII. 3, 6, 10, 12, 16; Auchterarder, CVIII. 6, 7, 10, 11, 13, 14, 16; CXVIII. 1, 5, 10, 14; Auchtergaven, LXII. 13; LXXIII. 6; Bendochy, LXIII. 8, 12; Blackford, CVIII. 5, 6, 9, 10, 13, 14; CXVII. 3, 12, 16; CXVIII. 1, 5, 10, 14; Blairgowrie, LXIII. 3, 8, 12; Coupar Angus, LXIII. 12; Crieff, XCV. 4, 12; XCVI. 13; CVIII. 1, 5; Findo Gask, XCVI. 8, 11; Fowlis Wester, LXXXIV. 5, 9, 10, 14; XCV. 4, 12; XCVI. 2, 3, 4, 5, 6, 8, 10, 11, 13; Glendevon, CXVIII. 14; Kinloch, LXIII. 3; Little Dunkeld, LXII. 13; Logiealmond, LXXXIV. 4, 10, 11, 12; Madderty, XCVI. 10, 11, 13, 14; CVIII. 1, 2, 3, 6; Methven, LXXXIV. 10, 11, 12, 14; XCVI. 4, 8, 11; Muckart, CXXVIII. 14; Muthill, CVII. 15; CVIII. 5; CXVII. 3; Trinity Gask, CVIII. 1, 2, 3, 5, 6, 7, 9, 10, 13, 14. *Zetland.*—Northmaven, XV. 13.

Six-inch Maps (Quarter Sheets—Revised). *Perthshire.*—66 NW. (filled in with parts of Argyllshire); 66 SW. (filled in with parts of Argyllshire); 67 NW., 67 SW., 67 SE.; 71 NW., 71 NE., 71 SW.; 72 NW., 72 SE.; 78 NE.; 79 SW., 79 SE.; 80 SE.; 82 SW.; 83 NE., 83 SE; 89 SE.; 91 SW, 91 SE.; 92 NW., 92 SE.; 93 SW.; 102 NW.; 104 NE., 104 SE.; 105 NW., 105 SW.; 106 SE.; 113 SW.; 114 NW.; 116 NW., 116 SW., 116 SE.; 122 NW.; 130 SE. (filled in with parts of Stirlingshire); 138 NW. (filled in with parts of Stirlingshire). Price 1s. each.

The Catalogue of the Ordnance Survey Publications of Scotland has been revised and corrected to the 1st January 1900. This is the last edition issued, but another edition is in progress.

ASIA.

Kozloff's Explorations in Central Asia.—M. J. Deniker summarises the observations of the Russian traveller in *La Géographie* (pp. 41 ff. 1901), where he points out that the last remaining unknown portion of the Gobi desert has now been investigated by MM. Kozloff, Ladyghine, and Koznakoff, who proposed to supplement the work of Potanine and Pievtsoff by studying the Mongolian Altai throughout its whole length, following as nearly as possible the axis of the range and its southern slope. This chain of mountains may be divided into two unequal parts by the meridian of the Kobdo valley: the western portion, with many peaks covered by perpetual snow, dividing the waters of the Kobdo basin to the north from those of the Black Irtish to the south, and bearing on its flanks the rich pastures frequented by the nomad Kirghiz; and the eastern portion, four times as long as the other, with a series of ranges lying in two parallel lines, of which the northern peaks barely touch the snow-line. Throughout its whole length, the mountain system presents an abrupt descent on the north, and a gradual slope to the south.

Accompanied by a party of eighteen persons, M. Kozloff left the *stanitsa* of Altaiskaya in July 1899, to investigate the region between the Russian frontier and Kobdo; and determined the altitude of the Ulan-Daban pass, on the frontier, as 2880 m. Thence, following the river Kobdo to the town of that name, which is situated on the Buyuntu near the point where the latter flows into the lake Kara-Usu, he found that this lake is much smaller than is shown on the maps of the preceding travellers. Kobdo is inhabited by Chinese; the Russians have only a few trading-houses, where manufactured articles are exchanged for wool and furs. In the meantime the other two explorers passed south through the valleys of Tsagan-Gol and Kobdo-Gol to lake Kobdo, encountering only the Uryankhs, a wretched population of Mongolian type, but speaking a Turkish dialect, and inhabiting the valley of Tsagan-Gol and that of the upper Kobdo above its confluence with the former, as well as the banks of the Tubla-Nor and the valleys of the Saksai and the Buyuntu; and the Kirghiz-Kirei, who nomadise along the middle course of the Kobdo and the lower Saksai, and through the district of the Dala-Kul. Many stone monuments were seen between the frontier and the town of Kobdo.

Leaving Kobdo at the end of August, M. Kozloff reached the valley which separates the northern chain from the southern. In the district of the sources of the Borjom, an affluent of the Tsitsik-Nor, there is a silver mine worked by Mongolians and Chinese. As far as Khulmu-Nor the mountains are formed of red and grey granites, denuded by weather. To the north-east is the Khargin-Tsagan-Nor, at an altitude of 250 m., whence the traveller proceeded directly east to lake Begher, between the low hills which form the northern chain and the high peaks of Khara-Atzarga and Burkhan-Buda of the southern; both ranges are covered with thick forests to a height of 1900 m. Near the Kharghin-Tsagan-Nor was found *sulkhir* (*Agriophyllum gobicum*), the seeds of which are dried and ground by the Mongols, and yield a flour similar to that of wheat.

To the east of the Burkhan-Buda mountain, and near the fresh-water lake Khuduk-Nor, the southern chain (Altain-Nuru) terminates. At Dalanturu, 22 kilometres east of that lake, the expedition made a long halt, and a party visited the salt lake Bun-Tsagan-Nor. Passing by the lake Orok-Nor and the mountains Iké-Bogdo and Baga-Bogdo, and crossing the Tatsin-Gol, which flows through rich pastures, Kozloff reached the Artsa-Bogdo, which marks the turn of the northern chain towards the south-east. Turning southward at Chatseringhi-Khuduk to cross the central Gobi, he passed through the depression of Goïtso, 600 m. above sea-level. The desert is a vast undulating surface in which the sand hardly covers the rocks: the *barkhans*, dunes of wavy outline, are from 3 to 10 kilometres in length and lie ESE. They are from 3 to 30 m. in height; their southern faces are abrupt, but the northern slopes are gentle. Between these dunes there are several oases where the nomadic population find fresh water at about 2 metres depth. M. Kozloff rejoined his companions, who had followed somewhat different routes, at Chortinton, south-west of Liang-Chau.

Steamers for Lake Van.—According to the Turkish press, an agreement has been arrived at between the Minister of the Civil List and the other Departments regarding the establishment of a steam navigation service on the Lake of Van, and the requisite steamers are about to be ordered.

Port at the Mouth of the Obi.—In view of the development during late years of trade between the mouth of the Obi and British ports, there is an intention to adapt one of the bays in the Gulf of Obi to the purposes of an export port. With this object, port works, such as are necessary for suitable anchorage, discharging and loading of vessels, will be undertaken.

Gold in the Philippine Islands.—Mr. F. F. Hilder, of the Bureau of American Ethnology, who has recently visited the Philippines, writes very hopefully of the mining future of these islands (*National Geographic Magazine*, December 1900). He says that in the island of Luzon there are few provinces in which gold does not exist in greater or less quantity, in veins and ledges in the mountains, or in the river sands and alluvial deposits. One of the best-known auriferous districts is that of Paracale, in the province of Camarines Norte, on the east coast of Luzon, where many veins and outcroppings of gold-bearing rock have been uncovered; the metal occurring in some places in combination with iron pyrites, with a trace of copper, blende, galena, and chromate of lead in orange crystals; in others the veins are grey in colour, containing gold, blende, iron pyrites, and sometimes, though seldom, native copper. The general trend of the strata is from north to south, except in the Gumihan and Lugos mountains, where the direction is to the north-west. The width of the veins is from 1 to 5 inches, up to 26 to 36 inches.

These mines are at present worked by the natives in a very desultory and wasteful way. The workings are seldom carried down further than 3 or 4 metres, although the ore becomes richer as the depth increases. The ore is carried to the surface in baskets, and when water is struck it is baled out with buckets, which are pulled up by a rope, or carried up a bamboo ladder. The gold-bearing rock is emptied from the baskets into a hollow in the rock, which serves as a mortar; the pestle or stamp consists of a heavy stone made fast to the end of a slender pole. After the rock has been crushed it is pulverised in a rude mill driven by buffaloes; the women then wash the material, and the sediment is smelted in a shell with charcoal, a bamboo being used as a blow-pipe. A sample of the metal thus obtained was found to consist of gold 77·94 parts; silver, 19; iron, ·05; silica, 3; and ·01 was lost. Only a small fraction of the gold contained in the ore is extracted. The metal is bartered to Chinese pedlars, and the workers get a very inadequate return for their labour, and are miserably poor.

Gold has also been found in the province of Tayabas, in the hills around the town of Antimonan; also in many of the spurs of the Caraballo mountains, in alluvial deposits in the Gapan country, and in the sands of the rivers Ango and Angalacan, in the province of Nueva Ecija, and in many places in the Caraballo de Baler country between that province and that of Nueva Viscaya. On the island of Polillo, lying off the east coast, it has been obtained from the shores of the river of the same name. Mr. Hilder enumerates many rivers in which the metal occurs in greater or less quantity: it is evident that gold is widely distributed throughout the island of Luzon; but it is not yet known how many of the deposits will be found payable under modern methods.

In the great southern island of Mindanao, the interior of which is almost unexplored, gold has been found in many places, chiefly on the north and east coasts. The principal placer deposits are near the towns of Initao and Iponan, where nuggets of one and two ounces have been discovered. In a ledge near Canimon there has been found an ore so rich that 100 ounces of gold have been taken from 75 feet of the vein. The productiveness of some districts has been known for centuries, but the industry has remained in the hands of natives, chiefly because of the difficulty of obtaining reliable labour, the opposition of the priests, and the ruinous taxation under Spanish rule. Thus Mr. Foreman, in his work, *The Philippine Islands*, says that, as a general rule, failure in mining speculations in these islands has been due to the unwillingness of the natives to co-operate with European capitalists; and that the inhabitants have been encouraged by the friars to resist innovation. The natives of rural districts will not submit to methodical

work at a fixed wage; and there is no effective legal authority to enforce contracts or to regulate the relations between the employer and his workers.

AFRICA.

Development of French Guinea.—The greater part of French Guinea still consists of vast regions of comparatively unknown country, which, important as it is from different points of view, has not yet occupied the attention of Europeans. Konakry, the capital, which ten years ago was a small negro village of about 200 inhabitants, consisting mostly of carriers and fishermen subsisting upon the few caravans which came there, has to-day a population estimated at 14,000, of whom 300 are Europeans. In place of one French and one German trading-house, twenty firms are now established, while all the tribes inhabiting the vicinity of the Niger are represented in the market-place.

A good wagon road of about seventy-five miles long connects Konakry with Frigniaglie, the capital of the Kanea district. Goumba, lying in the north-east, with Missidi in the valley of the River Kolenten as capital, is a mountainous country, with sharp cliffs rising 500 and 600 feet above the valleys, which latter promise well as a future field for cattle-raising. Beyond is Fonta-Djalon, a vast tableland of granite, unfertile, with nine-tenths of a surface naked, until the month of March, when the rainy season begins, when it is covered with a frail and delicate clothing of grassy plants with roots which appear to be buried in solid rock, and which rise to a height of three feet by the month of June, burying the landscape three feet thick in luxuriant vegetation.

Timbo, the capital, is almost in ruins. East of it is the fertile valley of the Tinkisso, where rice, maize, and millet are successfully cultivated. The source of the Tinkisso is 3280 feet above the level of the sea, an altitude which drops to 984 feet at Bissikhrima. Several formidable rapids and cascades, the principal of which is at Kambaya, mark its course. From Bissikhrima to Dinguira the country is a desert; Boné is a long succession of ragged tablelands cut by two wide and deep rivers; while Badiar, to the north, is a flat plain, the beginning of the desert extending from the Rio Grande to the Senegal.

Rainfall of the Cape Peninsula.—At a recent meeting of the South African Philosophical Society, Mr. T. Stewart, Vice-President, communicated certain observations on rainfall at the Cape. He pointed out that in the year 1876 there were only three stations in the Cape Peninsula from which rainfall returns were received by the Meteorological Commission. These stations were the Royal Observatory, Wynberg, and Simon's Town. Since then the number of stations has been added to from time to time, making in all thirty-two stations, from which returns were received by the Meteorological Commission in 1900. In addition to these, there are seven stations on Table Mountain, from which regular observations have been taken for use in connection with the supply of water to Cape Town and Wynberg, but the returns have not been forwarded for insertion in the annual reports of the Meteorological Commission. Observations have been obtained from thirty-one stations in the Peninsula for five years or more, together with the yearly rainfall at each station. In cases where the observations have extended to seven years, the average has been worked out for these years; in a few cases the average rainfall for sixteen years has been given. The rainfall is very unequally distributed. The average for the last seven years at Signal Hill is 15·49 inches; at Rondebosch 41·22 inches; at Kenilworth 42·90 inches; at Disa Head (2500 feet above the sea) on Table Mountain, 36·96 inches; and at Maclear's Beacon (3478 feet above the sea) on Table Mountain, 86·81 inches. The heaviest rainfall in the Peninsula is registered at the last station. The following is a comparison of the

results obtained from the Disa Head gauge with those from Maclear's Beacon for the last seven years :—

	Disa Head.	Maclear's Beacon.
1894	35·10	74·08
1895	37·88	94·37
1896	38·68	73·34
1897	38·26	98·24
1898	43·08	92·67
1899	34·95	105·85
1900	30·02	69·14

The Disa Head gauge does not appear to give a correct idea of the rainfall in its immediate neighbourhood. This is clearly proved by the reading of the other gauges close by it being much in excess. For example, the Dam gauge, which is only about a hundred yards distant, and about a hundred feet below the Disa Head gauge, registers about one-third more rain on an average. This difference is clearly due to the broken nature of the country.

Glacial Action in South Africa.—At the same meeting Mr. A. W. Rogers read a paper on "Evidence of Glacial Action during the Deposition of the Table Mountain Sandstone." He said that the Cederbergen in the neighbourhood of Clanwilliam are formed by a wide anticline of Table Mountain Sandstone trending north-west. On the Pakhuis Pass, by which the Clanwilliam-Calvinia road crosses the range, a shale band lying about 1000 feet below the top of the Table Mountain Sandstone differs from the rock on the same horizon elsewhere in being in part an unbedded sandy mudstone with typical glaciated pebbles scattered throughout it. The pebbles consist chiefly of grits, quartzites, and granites, but small rounded pebbles of quartz, such as are abundantly found in the Table Mountain Sandstone elsewhere frequently occur. Parts of the conglomerate are bedded, and become in places ordinary shale by the decrease of the sand and pebbles. Other parts approach in character the usual sandstone of the Table Mountain Sandstone group by increase in the quantity of quartz-sand. The course of the outcrop of the rock, and the dips observed in the shaly portions, furnish the evidence of its being interbedded with the Table Mountain Sandstone, and negative the supposition that it is an outlier of the Dwyka Conglomerate, which it resembles in important features, although there are striking differences in the contents of the two conglomerates. The Pakhuis rock is only exposed on the roadside by the cutting of the shelf for the road. Elsewhere the rock is concealed by debris fallen from the overlying sandstone, and its outcrop is marked by a steep bushy slope.

AMERICA.

Meteorological Observations in Mexico.—We have received from Mr. Robert Hay Anderson of Mexico the following summary of meteorological readings recorded during 1900 in the Central Observatory, City of Mexico :—

Mean temperature in the shade,	16·0 C.
Mean temperature in open air,	16·4 C.
Max. temperature in the shade,	30·0 C. April
Min. temperature in the shade,	2·0 C. February
Max. temperature in open air,	36·0 April
Min. temperature in open air,	2·0 below zero, February
Greatest daily variation in shade,	19·6 February
Greatest daily variation in open air,	29·0 February
Total absolute variation in shade,	28·0

Total absolute variation in open air,	38·5
Mean temperature of water in shade,	13·2
Mean temperature of soil, 0·85 metre deep,	15·4
Mean atmospheric pressure,	585·66 mm.
Max. atmospheric pressure,	590·95 mm. April
Min. atmospheric pressure,	580·71 mm. March
Greatest daily variation,	4·89 mm. February
Least daily variation,	1·51 mm. December
Total annual variation,	10·23 mm.
Prevailing direction of wind,	N.
Maximum velocity of wind in April from SW., and in June from NE. and E.,	17·00 m.
Prevailing direction of clouds,	NE.
Number of cloudy days,	153
Number of partially cloudy days,	130
Number of clear days,	82
Mean monthly tension of vapour in shade,	8·03 mm.
Mean humidity of air,	57%
Mean daily evaporation in shade,	2·1 mm.
Mean daily evaporation in open air,	5·6 mm.
Max. daily evaporation in shade,	4·2 mm. May
Max. daily evaporation in open air,	10·0 mm. June
Total rainfall,	535·9 mm.
Greatest rainfall in twenty-four hours,	32·0 mm. July
Number of tempests in the year,	21
Number of rains accompanied by hail,	4
Number of days with rain,	146
Hottest months in the year,	April and May
Coldest months in the year,	February and December
Month of highest barometric pressure,	August
Month of lowest barometric pressure,	April
Windiest month,	June
Cloudiest month,	July
Clearest month,	February
Rainiest month,	July
Driest month,	February

The meteorological observations of the year give an average little different from that of twenty-three years.

The late Dr. George M. Dawson, director of the Geological Survey of Canada, died on March 2nd at the age of fifty-one. He was a son of the late Sir John William Dawson, who was well known for his researches in geology and natural history, and was born in Nova Scotia in 1849. Having been educated at M'Gill University, he came to London in his twenty-first year, and studied for three years at the Royal School of Mines with great distinction. Returning to Canada, he was appointed to a lectureship in Morrin College, Quebec, and at the same time undertook extensive mining surveys in his native island. In 1873 he was appointed botanist and geologist to the North American Boundary Commission, which was charged with the determination of the boundary from the Lake of the Woods to the Rocky Mountains. He was occupied in this work for two years, during which he wrote a monograph, illustrated by maps and drawings, of the geology of the country and its resources; preparing, at the same time, papers on the lignite

tertiary formation, the superficial deposits of the great interior plains of America, the fresh-water sponges of Canada, the fluctuations of the American lakes, and the locust visitation. Dr. Dawson joined the Geological Survey of Canada in 1875, and became assistant director in 1883, and director in 1895. He was one of the British Commissioners in connection with the Behring Sea arbitration, and spent the summer of 1892 in the region of the Behring Sea in order to study the conditions of seal life. For these services he received the thanks of the Governor-General in Council, and the C.M.G. Queen's University conferred on him the degree of LL.D. in 1890, and M'Gill University recognised his labours in a similar way in the following year. The London Geological Society awarded him the Bigsby gold medal in 1891, and he received the gold medal of the Royal Geographical Society in 1897. Dr. Dawson was also a Fellow of the Royal Society, President of the Royal Society of Canada, Fellow of the American Association for the Advancement of Science, and a corresponding member of the London Zoological Society.

Trade and Industry in Greenland.—The *Board of Trade Journal* (January 3, 1901) gives an outline of the working of the Royal Danish Greenland Company, which has an absolute monopoly of the trade of the colonies. These extend on the west coast of Greenland from about 60° to 72° N. ; from the south northward, their names are : Julianehaab, Frederikshaab, Godthaab, Sukkertoppen, Holstenborg, Egedesminde, Kristianshaab, Jakobshaven, Ritenbenk, Godhavn, Umanak, and Uppernivik ; on the east coast there is a mission and trading-station at Angmagsalik, established in 1894 for the benefit of the heathen population, which numbers about 400. The trade was transferred in 1750 to a private company ; but this was so unsuccessful that in 1774 the government had to take it over, and has monopolised it ever since. Two inspectors were appointed, whose business it was to protect the natives from unscrupulous merchants, and to further the whale-fishing and other industries in every way. Since the year 1830 the trade has yielded an annual surplus. The whole of the west coast, between 60° and 73° N., is closed to all shipping except by special permission of the Danish Government ; and foreign travellers are forbidden to enter any part of Greenland. A fixed price is set by the administration for all buying and selling ; and the inspectors are instructed to see that the natives do not dispose of more than they can spare from domestic use. The native is unable to purchase spirits, even in the smallest quantities, from the administration.

The trade, which is carried on exclusively by means of the nine small vessels owned by the company, having a total tonnage of only 2000 net, consists of miscellaneous manufactured articles and provisions imported to Greenland, and of seal-oil, seal-skins, bear and fox skins, and eider-down exported. The colony produces about 10,000 casks of seal-oil annually ; this always commands a good price, because it cannot be adulterated. The seal-skins number about 30,000, and the bear-skins about 100 every year.

The Census of Cuba, undertaken by the War Department of the United States in October and November 1899, is the subject of a voluminous report published in Washington, 1900. The chief observations of geographical interest are the subject of an article by M. L. Gallois (*Annales de Géographie*, January 1901), from which the following notes have been taken. The census was carried out by Cubans under the direction of Lieut.-Col. Stanger and Mr. V. H. Olmstedt ; and the publication of statistics was directed by Messrs. Henry Gannett and Walter F. Wilcox. The population of Cuba and of the dependent Isle of Pines was returned as 1,572,797 ; at the time of the previous census (1887) the number was 1,631,687. There was

therefore a decrease of 58,890, or 3·6 per cent. ; but, since it is to be supposed that the population had increased at its normal rate until the outbreak of hostilities, it is estimated that the number at the beginning of the war was 1,800,000, and that the true decrease was not less than 200,000, or 11 per cent. The decrease was not shown equally by all the provinces : the two most easterly provinces, of Santiago de Cuba and Puerto Principe, show, on the contrary, an increase ; but the four others, Santa Clara, Matanzas, Havana, and Pinar del Rio, have everywhere lost population, except in certain districts where *reconcentrados* had been established, and in others where refuge could be taken from the war, as in the most remote portions of Pinar del Rio or the great swamp of Zapata. A notable result of the war is the small proportion of children below five years of age ; there are 100,000 fewer infants than there would have been under normal conditions. The war may be followed year by year and province by province in the extraordinary diminution of the birth-rate.

The total area of Cuba, according to the War Department's map of 1 : 500,000, is 44,000 square miles ; the mean density of population is therefore low. The urban population is high in proportion to the whole ; taking into account towns of not less than 8000, the census finds 507,831 in the sixteen towns included, that is, 32·3 per cent. If villages of not less than 1000 are included, the proportion becomes 47 per cent. In the United States the proportion of the urban population to the whole is 29·2 ; in Porto Rico, 8·7. This town population is chiefly on the coast ; but it is not so to such an extent as is commonly observed in islands. The four largest towns, Havana (235,981), Santiago (43,090), Matanzas (36,374), and Cienfugos (30,038), are seaports ; but the fifth, Puerto Principe, in spite of its name, is in the interior. M. Gallois remarks that if a general map of the density of population in Cuba were drawn up, using as low a unit as possible, the most striking feature would probably be the relatively high proportion of the population of the interior, especially in the west.

Like the other islands of its group, Cuba consists of ancient mountain chains, largely covered by calcareous deposits, out of which arise isolated mountain masses. This calcareous deposit is not horizontal, but has been raised to the north-east, lifting with it terraces of coral formation, analogous to the reefs which are still being formed along the coast. It is depressed in the south-west to the marshes. About 25 per cent. of the island is mountainous ; 60 per cent. consists of plains and valleys ; 15 per cent. is marshy.

The tropical climate affords magnificent vegetation. Formerly Cuba was entirely covered by forests of palms and pines, and rich in acajou and ebony ; but now fully one-half of the surface has been disforested, and there are great expanses which have almost the appearance of savannas dotted with isolated specimens or groups of the palm *Oreodoxa regia*. Rain is abundant, the annual mean being 1·30 m. at Havana ; the wet season lasts from May to October.

The eastern portion of the island is the least cultivated ; before the war the raising of stock was the chief occupation in the province of Puerto Principe. Towards the west, cultivation increases ; sugar-cane is grown in Santa Clara, Matanzas, and Havana, and tobacco in Pinar del Rio : but only 3 per cent. of the whole island is cultivated. The sugar-cane covers 47 per cent. of the cultivated area. The plant is productive for about nine years. The industry was introduced in the sixteenth century, but its great extension began only in 1853. From 1,193,091 tons of crude sugar produced in 1894, to 240,041 in 1897, is a fall in production which must be ascribed both to the war and to the general depression of the industry ; the figure for 1900 was 321,092. The future of sugar in Cuba depends largely upon the American tariff, which at present hinders it greatly. Tobacco is the second crop in importance : 72 per cent. of the cultivated land of Pinar del Rio

is devoted to it, or 9·6 per cent. of the cultivation of the whole island. During the earlier part of last century Cuba produced a considerable amount of coffee, but that industry has been killed by Brazilian competition. A few years ago bananas were exported to the States; and the conditions are suitable for other tropical fruits. Iron, manganese, and copper are mined to some extent in Santiago, but the country must continue to depend on agriculture. No less than 48 per cent. of the population is occupied in agriculture; 14·9 in industry; 12·8 in commerce and transport; only 1·4 in professional life.

The proportion of whites to coloured races is 67·9 to 32·1; this proportion has not changed since 1877, before which year the blacks were relatively much more numerous, as they are now in all other islands of the group and even in the southern States east of the Mississippi. The Cuban negroes own or farm only 11 per cent. of the cultivated lands. Of the whites, 86 per cent. are natives; the rest are strangers, almost exclusively Spaniards. The Chinese, who were imported by contract after the emancipation of the slaves, do not amount to 1 per cent.; there are now only 14,837, most of those who were introduced between 1853 and 1877 having died or left the country.

Patagonia.—Count Henry de la Vaulx, who travelled through the southern extremity of America, from the Rio Negro to the strait of Magellan, in the years 1895 to 1897, has published his topographical studies of that region in the first number of *La Géographie* for the current year. A circumstantial account of his experiences in Patagonia appeared recently in his volume, *Voyage en Patagonie*. The author estimates highly the advantages which that country offers to the colonist, and describes its natural features and resources, and the fortunes of immigrants. Extending from the right bank of the Rio Negro to the strait of Magellan, Patagonia is divided politically into two parts: Argentine Patagonia, subdivided into the three territories of Rio Negro, Chubut, and Santa-Cruz, and extending as far south as the 52nd parallel; and Chilian Patagonia, a narrow strip of land extending from 52° to 55° S., having as its capital Punta-Arenas. A few Europeans are engaged in trade, agriculture, and ranching along the coast; the interior is occupied by nomadic tribes. The country consists of a succession of high plateaux separated by well-watered valleys: the former, which are covered with stones and thin grass, have given rise to the general opinion that Patagonia is altogether sterile; but the great valleys, through which flow considerable rivers, such as the Rio Negro, the Chubut, and the Santa-Cruz, are exceedingly productive. Besides the river courses, which are traced out in detail by the author, there are many lagoons and certain large lakes.

The Argentine government is doing much to encourage the colonisation of the northern portion. Several ports have been established, notably Bahia-Blanco and Puerta Madryn, and important military forces have been concentrated at Rocca, on the Rio Negro, and in districts further west. There is a railway from Rocca to Buenos Ayres, and the most outlying parts of the country are connected by telegraph with the capital. Chili, on the other hand, is developing its territory; and the frontier dispute, in which the western Power claims the water-parting as boundary, while Argentina draws that line along the summits of the principal chain of the Andes, has led to very thorough exploration on both sides, revealing the fertility and beauty of the greater part of Patagonia.

The temperate and wholesome climate is an advantage of the first importance for the development of this region; and most of the land is suitable for cultivation; some of it, indeed, is fertile in a very high degree. The Welsh colony in Chubut offers one of many examples of striking success in agriculture; the cereals of

Patagonia are known for their high quality: and European fruits and vegetables find soil and climate very suitable. Ranching has been carried on to a large extent with fortunate results. British colonists who acquired extensive lands on the shores of the strait of Magellan and in the region between 50° and 55° S., and imported Lincolnshire sheep from the Falkland Islands, found that the breed was immediately acclimatised; the flocks doubled themselves in three years, and yielded remunerative wool.

There are gold-mines of considerable importance, and several alluvial deposits. Silver is mined by the natives, and all the country in the region of the lakes Colhué-Huapi and Munster is rich in iron ore, making the traveller's compass quite unreliable. The slopes of the Cordillera are well wooded, and several saw-mills are at work on the strait of Magellan. In the north the forest tree is a kind of pine, which is found again on the strait in the south; between these regions the *roble*, erroneously called an oak, but very similar to the beech, grows to a great size and yields a hard and valuable timber. Extensive salt-works occur along the Atlantic coast, and even as far as the foot of the Cordillera: the cod and the seal are abundant, yet are not fished; and there are deposits of guano sufficient for the requirements of the country for some time to come.

The Welsh colony was founded in 1865 by immigrants without capital, who received no support from the government. At present its total population is more than 2500; three villages, Rawson, Trelew, and Gaiman, connected with roads along which stand the farms of the settlers, have every appearance of comfort and industry.

ERRATUM.—In Mr. Alexander Begg's *Review of the Alaskan Boundary*, p. 87, 5th line, the year 1728 should read 1798.

NEW BOOKS.

Turkestan, die Wiege der indogermanischen Völker. Nach fünfzehnjährigem Aufenthalt in Turkestan dargestalt von Franz V. Schwartz. With 179 Illustrations, one of them coloured, and a Map. Pp. 606. Herdersche Verlagshandlung, Freiburg im Breisgau, 1900.

With commendable industry Herr v. Schwartz has placed on record the notes made by him during his fifteen years' sojourn in Turkestan, supplementing them by what he has garnered from other authors during the last ten years spent at home. The work has therefore not been done in a hurry. Under a number of headings he methodically describes the manner of life and some of the manners and customs of the various nomad tribes, then of the settled population with the trades and industries they pursue. To those that know nothing of the Transcaspian region under Russian rule, this volume will furnish a large store of reliable facts. Those, however, that keep themselves abreast of the geographical and ethnological literature of Central Asia, will find here little that is new. Though some little notice is taken of native usages, the ethnologist will search in vain for any new fact relating to the customs that cluster round birth, marriage, death, seed-time, harvest, and the like. In fact, the psychological side of the natives is almost wholly neglected. This is the more astonishing as the volume is included in a "Geographical and Ethnological Library."

Though it is still a moot point where the original home of the Indo-Europeans lay, the author is quite positive that it was in Turkestan. He also maintains that the Gauls and Germans did not separate from the main stock till the use of iron was

known, and that the word *Galatai* (the Gauls) is merely a Greek form of Galcha, a Persian-speaking people in the mountains of Badakshan. Here he quite forgets that the word Galcha is first used as late as 1604, and is hardly known to the natives themselves. In these and other matters pertaining to prehistoric problems we cannot admit that the author is right, or indeed that he is competent to deal with them.

The last chapter is devoted to the climatic conditions of Turkestan. After proving the gradual desiccation that is taking place over the whole area, owing to the excess of evaporation over precipitation, Herr v. Schwartz regards the future outlook as extremely black. He brings his narrative to a close with the doleful prophecy, "Turkestan has no economic future: it is doomed to inevitable ruin."

The illustrations are both numerous and good, some very good.

After Wild Sheep in the Altai and Mongolia. By E. Demidoff, Prince San Donato, author of "Hunting Trips in the Caucasus." With 82 Illustrations, a coloured Frontispiece, and Map. London: Rowland Ward, Limited, 1900. Pp. xii + 324.

The author, accompanied by his wife, and by Mr. and Mrs. St. George Littledale, made his expedition in 1897. Their object was sport, pure and simple; but they hoped also to collect examples of the flora and lesser fauna, as well as specimens illustrating the geological formation of the little-known region for which they were bound. As regards sport among the great wild sheep (*ovis ammon*) the expedition was most successful; but, owing to unavoidable circumstances, very little was accomplished in other ways.

The party, which had the advantage of valuable introductions and facilities of travel, journeyed by the Siberian railway up to the Ob river, and thence by way of Barnaoul to their hunting-grounds, which lay to the south-east in the Altai mountains, astride of the boundary between Siberia and Mongolia. The book is not a mere narrative of sport; it contains also a most interesting account of the country which the expedition passed through or explored in search of game, and of the people that inhabit it; and the picture drawn is rendered the more realistic and attractive by the numerous well-chosen and beautifully executed illustrations with which the author has adorned his pages.

The book is got up in first-rate style, and its perusal will well repay the general reader as well as the sportsman.

The British Empire Series.—Vol. IV. Australasia. London: Kegan Paul, Trench, Trübner and Co., Ltd., 1900. *Price* 6*s.*

The fourth volume of the British Empire Series has been issued very quickly after the third, and is constructed on the same lines as its predecessors, *i.e.* the papers are for the most part lectures delivered at the South Place Finsbury Institute, from 1895 to 1898. But, so far as Australia is concerned, a great deal has happened since 1898, not to speak of 1895, and so a general introduction has been written by the Hon. Sir J. A. Cockburn, in which we have a succinct and clear exposition of the new constitution promulgated this year for the Commonwealth of Australia, a landmark in history which will be remembered long after the memory of the Transvaal War has sunk into oblivion. The names of the writers are a guarantee for the accuracy and variety of their knowledge of their subjects, and many of them are well known as leading authorities on Australasia. We refer to such names as Sir J. A. Cockburn, already mentioned, Sir William Robinson, Messrs. Jerome Dyer, Shortt Dickens, W. P. Reeves, G. Collins Fevey, etc. The

general tone of the lectures is decidedly optimistic, and indeed the principal difficulty that an intending emigrant would have, after a perusal of the descriptions in this book, is to make up his mind as to which of the colonies presents the greatest attractions. For with the exception of British New Guinea and some of the islands of the Western Pacific, all the colonies are depicted as ideal homes, where health, prosperity, and success await all classes of society who care to settle in them. We have also interesting chapters on the "Lost Tasmanian Race" and the Maoris, and on the Women of Australasia. *A propos* of the last-mentioned, Mrs. Hirst Alexander claims Mrs. Humphrey Ward and Mrs. Mannington Caffyn (Iota) as Australian novelists, whereas Mr. Patchett Martin, who contributes an interesting chapter on "The beginnings of Australian literature," asserts that Mrs. Ward, "despite her birthplace, has nothing whatever to do with Australian literature," and Mrs. Caffyn "*may yet* produce some work which will entitle her to rank among the founders of the still unformed school of Australian fiction."

The book is equipped with good maps of Australia and New Zealand, and a table of useful statistics, setting forth the population, revenue, expenditure, exports, imports, indebtedness, etc.

The Traveller.—Vol. I. London: George Newnes, Ltd. *Price* 10*s.* 6*d. net.*

An endless variety of information is contained in this, the first volume of *The Traveller*. The book should appeal to those who are about to travel and those who have travelled: both sections will profit by a perusal of its pages. Papers by well-known writers, hints, notes and queries, are given on topics, subjects, and places likely to be interesting to the globe-trotter, besides other matter of a more general character. The illustrations and printing are certainly commendatory.

The Shakespeare Country Illustrated. By JOHN LEYLAND. London: George Newnes, Ltd., 1900. Pp. 102. *Price* 10*s.* 6*d. net.*

This volume of "The *Country Life* Library," with its beautiful illustrations and excellent text, fittingly describes the most famous resort of the English-speaking world. Mr. Leyland gives an interesting explanation, which is new to us, of Shakespeare's own epitaph upon his tomb in Holy Trinity Church, begging, "for Jesus' sake," that his bones be not disturbed, by pointing out that, in Shakespeare's day, the north aisle of the chancel of Holy Trinity Church was a charnel-house some thirty feet long, fifteen feet wide, and very high, and that, although this "place of horror" was taken down in 1800, traces of it were discovered in 1882, when huge piles of skulls were found upon its site. Mr. Leyland suggests that the sexton scene in *Hamlet* was probably frequently witnessed by Shakespeare in and around Holy Trinity Church, Stratford-on-Avon. Admirable reproductions are given of the Droeshout, Chandos, and Stratford portraits of Shakespeare. The only thing the volume lacks is a sketch map of "the Shakespeare Country," and we may add that such maps can be very artistically rendered in keeping with a *livre de luxe* like this.

England, Egypt, and the Sudan. By H. D. TRAIL, D.C.L. Westminster: Archibald Constable and Co., Ltd., 1900. Pp. 232. Index and four Maps. *Price* 12*s.*

As might be expected from the name upon the title-page, this book is an admirable account of the subject with which it deals, and, as might be expected, it is well written and convincing in its arguments.

Commencing with the establishment of the Khedivate, an account is given of what has taken place in Egypt and the Sudan during recent years. Arabi and

his rebellion are dealt with, the fall of Khartoum and the sacrifice of Gordon, the advance of Lord Kitchener and the overthrow of the Mahdi's power, and then the Fashoda incident, are described, and finally the reason-why for Great Britain's action in Egypt is clearly set forth.

Although we have nothing but praise for the book itself, yet we have an apparently ungracious duty to perform, more especially as the author of the volume has so recently passed away. There is no preface to the book, and therefore we are in ignorance as to whether or not he prepared it for the press. We hope he did not, because those of our readers who are acquainted with Mr. Arthur Silva White's book, published in 1899, on *The Expansion of Egypt under Anglo-Egyptian Condominion*, will be surprised to find that in many cases Mr. White's arguments have been followed, and not only so, but his sentences have been incorporated in this book, frequently word for word, or else paraphrased, without any quotation marks, and with no acknowledgment, save that on page 224 he refers to him as "a recent writer on Egypt," whilst he uses to the full Mr. White's sea-power argument. And again, on page 229, where he refers to Mr. White, but gives no reference to his book, notwithstanding that he copies almost verbatim his account of the French occupation of Tunis; and elsewhere—*e.g.* with regard to the Suez Canal treaties, he follows him most closely.

If we turn to Dr. Trail's book, page 199, twelve lines from the top, we read, "France having definitely arranged her frontier with the Congo State by a boundary agreement of 1894, and having in her convention of a later date with Great Britain adjusted and defined the other interests of the two nations in the region of the Niger, was left with a vast but vague sphere of influence, the boundaries of which towards the Central Sudan were necessarily undefined." And so on. In Mr. Silva White's book, on page 418, we find the very same words, with the curious exception that the date of the boundary agreement is omitted by Dr. Trail, and "a later date" takes the place of Mr. White's "14th of June 1898."

Again, Dr. Trail, pp. 203-7, follows Silva White closely, pages 420-3 and 427-8. For instance, compare Trail, page 203, and Silva White, page 423. Trail writes, "A glance at the map will show that, in this agreement with France, Great Britain obtained all that she ever claimed on behalf of herself and Egypt, namely, recognition of the unity and integrity of the Nile Valley," etc., to the end of the paragraph "British and Egyptian interests is clearly indicated." Mr. Silva White writes, on page 423, "It will thus be seen that in her agreement with France, Great Britain obtained all that she ever claimed on behalf of herself and Egypt," and so on to the end of the paragraph "British and Egyptian interests is clearly signalised."

We have only space to point out one more of these unfortunate coincidences! We read in Dr. Trail, page 227, fourteen lines from the bottom, "That is the verdict of every official in the country and of every impartial critic who has ever studied the country; it is recognised even by France herself." Mr. Silva White writes, on page 355, thirteen lines from the bottom, "This is the verdict of every official in the country and of every impartial critic who visits the country; it is the verdict, too, of the French."

We have felt it our duty to call attention to this great blemish, but the general reader will not be expected to notice it, and for him the book is likely to possess a great charm, because it is only right that the general reader should obtain a clear idea as to the events which led up to and necessitated our national interest in the land of the Pharaohs, and that they should also grasp the advantage which our occupation and protection of the country have been to the inhabitants.

If they will do this, they will take an intelligent interest in the progress of Egypt, and also understand how, whether we like it or not, her progress is bound up, for many years at any rate, with our continued tutelage.

The errors and ignorance which led to the abandonment of the Sudan, and the resulting enormous loss of life, should serve also when put before the public, in Dr. Trail's burning words, as a warning that such an occurrence must never again take place, however loudly called for it may be by an ignorant and loud-voiced minority. It is not a chapter of which we as a nation can be proud, but if we learn the lesson it should teach, good in this case, as so often, may come out of grave evil.

The Rockies of Canada. By WALTER DWIGHT WILCOX, F.R.G.S. G. P. Putnam's Sons. New York and London: The Knickerbocker Press, 1900. *Price* 15*s.*

In this new century, when it is understood that energetic members of the Alpine Club are beginning to feel like Alexander the Great, and to thirst for new worlds to conquer, that is to say, new mountains to ascend, we feel we are doing them a kindness in inviting their attention to this excellent work by Mr. Wilcox, who long ago won his spurs as a fearless and successful mountaineer by his ascents of two peaks of the Rocky Mountains, viz., Mounts Temple and Aberdeen, the former 11,607, and the latter 10,450 feet in height. In it he describes with exceptional force and skill the formidable task which a Canadian mountaineer has before him, and he illustrates this from his own exciting and often painful experiences in a simple but convincing way, which will appeal to the heart of every true mountaineer. Let the jaded veterans of the Alpine Club listen to this. "The Rockies of Canada offer exceptional opportunities to the mountaineer. The time has not yet come when the climber must travel far into the wilderness to find peaks that have never been attempted. There are hundreds of unclimbed mountains within a few miles of the railroad, and it may safely be said that mountaineering in the Canadian Rockies is now making its early history. Few other easily accessible ranges in the world possess the rare charm of the unexplored wilderness, where each attempt is a reconnaissance for the best route, and every view is looked upon for the first time by human eyes. Perhaps because of this element of novelty *no great mountain is ever climbed twice.* Every one prefers to attempt a lesser peak, that is absolutely new, than to retrace some other party's steps on a higher mountain."

The mountains, it is true, are not so high as those of the Alps; the champions of the Rockies do not exceed an altitude of 13,000 feet, but the rewards to the mountaineer are quite as great as those which fall to the lot of him who ascends the Jungfrau or the Matterhorn. The difficulties to be encountered are quite as great as those of the Swiss mountains; there is the same need of iron nerves, perfect training, and physical condition; and there are more numerous and exacting opportunities for the exercise of individual judgment and discretion and prompt decision, for it has to be remembered there are no guides. Much of course depends on the weather, and of this Mr. Wilcox can only say, "The only certain thing about the weather is its uncertainty, though in general, fine weather is the rule and rain the exception." In mountaineering expeditions in the Rockies mules are of no use. Their place is taken by the *cayuse* or Indian pony, which seems to have been specially framed by nature for such work. Mr. Wilcox had a bay which excelled as a tracker, and made a circuit of a quarter of a mile from the trail to avoid a fallen tree which it had seen only once, and that more than a year before. This same pony cleared a log three feet ten inches from the ground of his

own free will while carrying a pack weighing over two hundred and fifty pounds on his back. The sportsmen in the Rockies will find moose, elk, deer, cariboo, wild sheep and goats, black and grizly bears, and small game like grouse, wild duck, ptarmigan, etc. The numerous lakes are reported to teem with excellent trout, the record in weight being one of forty-seven pounds weight, caught at Lake Minniewanka in 1899 by Dr. Webb. That Mr. Wilcox has the eye of a true artist and a keen appreciation of the beauties of nature, is clear from his enthusiastic and eloquent descriptions of the scenery through which he wandered, and from the beauty of the photogravures with which his book is abundantly illustrated. There are also two useful maps, showing the general outlines of the track covered by the Rockies between lats. 50° 30′ and 52° 30′.

The Story of Egypt. ("Story of the Empire Series.") By W. Basil Worsfold. London: Horace Marshall and Son. *Price* 1*s.* 6*d.*

The reader who looks in this book for the story of Egypt cannot fail to be disappointed, for its story from a period "further removed from the men of the Græco-Roman age than the remains of ancient Athens and Rome are removed from us to-day" down to the beginning of the nineteenth century is merely glanced at in some thirty small pages. The bulk of the book is devoted to describing what has happened to Egypt from the days of Mahommed Ali till now, and gives us a readable though sketchy account of the difficulties between England and France, the loss and reconquest of the Sudan, the reforms and improvements introduced by Lord Cromer and his able lieutenants, Milner, Scott Moncrieff, West, Sir John Scott, etc. The book is hardly up to the level of the rest of the Empire Series.

Among the Women of the Sahara. From the French of Mme. Jean Pommerol, by Mrs. Arthur Hill. London: Hurst and Blackett, Limited, 1900. *Price* 12*s.*

This volume contains a translation by Mrs. Arthur Hill of the work of Mme. Pommerol, which describes her impressions of the women of the Sahara between El-Aghuat and In-Saleh, a comparatively well-known tract of French Sahara; and we gather that another volume may be expected describing the women of the Tuat oasis and the Tuaregs of the south and east. In turning her attention to the women of the Sahara, Mme. Pommerol certainly attacked a subject of which for obvious reasons very little was known, and she has put before us the results of her studies in a very pleasant and readable form. Her task was often one of no small difficulty—not from the men of the Sahara, who apparently looked upon her proceedings with more or less contemptuous indifference or amusement—but from the women themselves, who regarded her sometimes with fear as a Rumi or foreigner, or more often with anger as a suspicious intruder, a frame of mind not only natural but almost inevitable under the circumstances. Her camera was an object of profound distrust and terror almost at all times. Mme. Pommerol does not mince matters in her description of the women. They seem to have no education whatever and are mere children of nature, acting on the impulse of the moment without reference to right or wrong, tempered, however, by a fear of immediate consequences at the hands of an infuriated husband or father. There are interesting accounts of domestic ceremonies, *e.g.* those at a marriage or a funeral, and some excellent descriptions of desert scenery and domestic life. Notwithstanding the difficulties above alluded to, Mme. Pommerol was able to take a good many photographs of women and places, and with these her book is well illustrated.

The People of China, their Country, History, Life, Ideas, and Relations with Foreigners. By J. W. Robertson-Scott. London : Methuen and Co., 1900. Pp. xii + 193. *Price* 3*s.* 6*d.*

This is a breezy, chatty book, quite fulfilling the purpose of its author. There are fourteen chapters taking up various aspects of the Chinaman and the Chinese question. These are grouped under five general divisions, namely, Introductory, with a brief description of external China ; the history of China, finishing with an epitome of the 'general scramble' ; the Chinaman, in which are treated such internal questions as government, education, literature, religion, and mental and physical characteristics ; the 'Foreign Devil,' with opium, spheres of influence, and trade ; and the Future, of which so much has been and is still being written. Two short appendices on the Boxers and men of the time in China end a very readable account of China and its people. The book is built up of a succession of short paragraphs, and the numerous quotations are printed in small type. This gives a lightness of appearance to the page, and enables the eye readily to catch the salient points of discussion. There are no illustrations, but there is a fairly good map of China, Japan, and Thibet.

The Far East, its History and its Question. By Alexis Krausse. London : Grant Richards, 1900. Pp. xvi + 372. *Price* 18*s.*

To one acquainted with the author's previous works, *Russia in Asia* and *China in Decay*, the general outlook of *The Far East* will be at once apparent. The book is essentially historical and political in character, and perhaps on that account calls for a brief notice in a geographical magazine. It is not, however, possible to ignore the fact that many political difficulties spring from geographical conditions, and that political necessity has compelled a closer study of geography. The first chapter is almost purely geographical, giving a rapid sketch of the countries and peoples in China, Korea, and Japan, and the neighbouring territories. Then follows an account of the rise of Western influence down to the Treaty of Nanking. To the subsequent opening up of China, to the development of Japan, and to the problem of Korea, three successive chapters are devoted ; and it is wonderful what an amount of sound information Mr. Krausse manages to get into each chapter. All this preliminary work is disposed of in 100 pages, the remaining 372 being taken up almost entirely with a discussion of what seems likely to be the Eastern Question of the new century. The author is of no doubtful mind as to the present tendency of events in the Far East. He recognises that diplomatically Great Britain is being beaten at every turn by Russia, and declares emphatically that unless some fundamental change is introduced into our policy and modes of carrying out our policy, Russia will win all along the line. This is the great text of which the book is largely an amplification. There is naturally a good deal of repetition ; but this is necessary, perhaps, so as to force upon the mind of the British public the vast questions with which, according to Mr. Krausse, our government is feebly tampering. That his strongly worded criticism has had little if any effect upon the mind of our statesmen is sufficiently evident to all who follow with intelligence the development of international relations in China. The book proper may be said to finish with page 256, the remainder being in the form of three Appendices, which will, however, be found of great service to the student. Appendix A is a chronology of historic landmarks, beginning with Genghis Khan, 1160, and ending with the entrance of the allies into the sacred city, 17th August 1900. Appendix B gives in 94 pages the important treaties and conventions which mark the progress of intercourse between the East and

the West: and Appendix C contains a bibliography of authorities on the Far East. Eight maps and five plans enhance the value of the book, from a perusal of which the reader will derive a broad view of the intricate paths by which the nations of Europe have met round the walls of Pekin.

Highways and Byways in East Anglia. By Wm. A. Dutt. With Illustrations by Joseph Pennell. London: Macmillan and Co., 1901. Pp. 406. *Price* 6*s.*

In this pleasantly written and prettily illustrated volume we find a vivid description of one of the most interesting and beautiful districts in England. In remarking that "Cromer is no garden of sleep," Mr. Dutt does not indicate that the so-called "garden" lies considerably to the south: nor does he refer to the remarkable "Strangers' Hall" at Norwich, a mediæval residence preserved by Mr. Bolingbroke. Mr. Pennell succeeds best as a rustic sketcher, for his views of the interiors of Norwich and Ely Cathedrals give no idea of their wonderful architectural effect, the sharp Norman features of Ely being represented by blurred lines. A map of the district, and also showing Mr. Dutt's route, is appended, an excellent example for other similar handbook writers to follow.

St. Kilda. By Norman Heathcote. With eighty illustrations from sketches and photographs of the people, scenery, and birds, by the author. London: Longmans, Green, and Co., 1900. Pp. 229. *Price* 10*s.* 6*d. net.*

In these pages Mr. Heathcote records in a graphic and lively way the experiences of himself and his sister during two summer trips to St. Kilda and the adjacent islands. The present stock of islanders is descended from colonists from Skye, who arrived about 150 years ago, and included men that had been deported for various crimes. Up till 1877 Gaelic was the only language spoken, but the rising generation have begun to learn and speak English. Mr. Heathcote found the inhabitants less bad than several previous writers have wished their readers to believe. He found them pleasant to deal with, and clean enough externally. He is not sure if they should be called lazy, but they waste an inordinate amount of time in conversation and deliberation before tackling any work in hand. They are the most truly religious people he has ever met, and, compared with the Highlanders, are not superstitious. At the same time they seem to have a marvellous facility for arriving at conclusions on the most imperfect, often purely imaginary, evidence.

The chief occupation of the islanders is fowling; farming and fishing are quite secondary considerations. There is a danger lest the Fork-tailed Petrel and the Stormy Petrel become extinct in these parts, like the Great Auk, owing to large orders for their eggs, which the islanders punctually execute.

Mr. Heathcote spent part of his leisure in surveying the islands, and the result is an excellent map, the first with any pretensions to accuracy that has been published, for which he deserves great credit. The book is abundantly illustrated, especially with photographs of the various kinds of sea-birds that swarm on the rocky coasts of this desolate, outlying group of islands.

Superstitions of the Highlands and Islands of Scotland. Collected entirely from oral sources. By John Gregorson Campbell, minister of Tiree. Glasgow: James MacLehose and Sons, 1900. Pp. 318.

This volume is posthumous, and we cannot but regret that the author was not spared to see it safely launched. It is a capital book, written in a thoroughly sane

and sober spirit. In this it differs from most books that deal with the manners, customs, and usages of the Gaels of Scotland, for in them the wildest theories, based mainly on fanciful ideas, are treated as facts and enunciated as truths. In gathering his material the late Mr. Campbell relied solely on oral communications made to himself, so that in every case of doubt he could interrogate his informant.

Attention is drawn to the fact that the Fairies (*Sith*) are different beings from the Glaistig or Gruagachs, and these are not to be confounded with the Brownie, a late importation from the lowlands. When Christianity first reached Ireland, the Fairies (*sidhe*) were regarded by the pagan Irish as gods of the earth, and there is a good deal in current Highland tradition that bears this view out. The *Sith* live underground, are the cause of good and bad harvests, but pasture their herds, especially deer, on the surface of the earth. The Fairies of Mull have perhaps borrowed from a Teutonic source the notion that such beings have but one eye, one nostril, a webfoot, long pendant breasts, and great voracity. At any rate these are characteristics of the Wild Women of the forest and the wilderness in German-speaking regions and in Scandinavia.

Many stories are given by the author to illustrate the belief in Fairies, Glaistigs, and other supernatural beings such as Mermaids and Water-horses. There is a chapter on miscellaneous superstitions under many headings; others on Augury, Divination, Dreams and Prophecies, Spells, the Black Art, and the Devil. Altogether the Folklorist will find here a treasury of interesting facts, thoroughly authentic, and excellent reading.

It is a pity, however, that the text is disfigured by so many Gaelic misprints we have noticed at least sixteen.

Canada under British Rule, 1760-1900. By Sir John G. Bourinot, K.C.M.G., LL.D., Litt.D. With 8 Maps. "Cambridge Historical Series." Cambridge: University Press, 1900. Pp. 346. *Price* 6*s*.

In a very lucid style and with great impartiality from a party point of view, Sir John Bourinot has presented the British public with a most readable *résumé* of Canadian history from its earliest beginnings to the present moment. To the ordinary reader, no doubt, the earlier chapters are the most interesting and stirring, but in the later ones that narrate the political development of the country, the gradual fulfilment of the popular aspirations towards a national Canadian government as an integral part of an Imperial Federation with the British Empire, have a special interest of their own.

It is difficult to realise that little over 260 years ago the French population in Canada, when Champlain, the founder of Quebec, died, did not exceed 150 souls, all of whom were dependent on the fur-trade. At this period, indeed, Canada seemed devoid of any real element of prosperity. It was nearly fifteen years later before the Falls of Niagara were first seen, and the well-known Lachine Rapids above Montreal received their name from the fact that the Sieur de la Salle, who had obtained a grant of land at the head of the rapids, was so deluded as to believe that he might find a short road to China by way of the St. Lawrence, so little was the geography of the globe known in 1666. And it is only 157 years since the Big Horn Range, an outlier of the Rocky Mountains, was reached. Their actual foot was not attained till 1751, when a fort was built on the Saskatchewan, not far from where Calgary now stands. At this period the English-speaking people in Canada, which did not extend westwards beyond the province of Quebec, and did not include New Brunswick and Nova Scotia, only numbered about 300 persons, while nearly 70,000 were of French origin. The

rest of the territory to the north and west was known as Rupert's Land and belonged to the Hudson's Bay Company.

It is interesting to Scots to know that so early as 1772 there began a steady stream of Scottish immigration, largely recruited from the Highlands, into Nova Scotia, and this continued for nearly fifty years. As a consequence, Gaelic is still, we are told, the dominant tongue in the eastern counties, where numerous place-names remind the travelling Scot of his ancient home.

The sad incapacity of the British generals during the War of Independence is related briefly in the third chapter. It is worth noting that "in the closing years of the war Great Britain had to fight not only France, Spain, Holland, and her own colonies, but she was without a single ally in Europe, and her dominion in India was threatened." Yet in spite of all these adverse circumstances, the Old Country managed to hold her own against the world. After the conclusion of the war the loyalists in the United States, who were really a numerous body, were so persecuted by the new republicans that as many as 35,000 were forced to take refuge in Canada. Of these some 25,000 settled in New Brunswick, and about 10,000 in the valley of the St. Lawrence. In 1780 they were already known as the "United Empire Loyalists."

In the next war between Great Britain and the United States from 1812-15, the latter on the whole got the worst of it. In their last battle at Chateauguay the republicans not only retreated in disorder, but never resumed the attack. "The war," says Sir John Bourinot, who is not one of those that think that all war is an evil, "did much to solidify the racial elements of North British America during its formative stage. The character of the people, especially in Upper Canada, was strengthened from a national point of view by the severe strain to which it was subjected. Men and women became animated by that spirit of self-sacrifice and patriotic endeavour which tend to make a people truly great."

In subsequent chapters are narrated the evolution of responsible government from 1815-39; the new era of colonial government from 1839-67; the evolution of confederation from 1789-1867; the first parliament 1869-73, together with the political and social condition of Canada under confederation. The tenth and last chapter sketches the relations of Canada with the United States and her influence in Imperial Councils from 1783-1900. The value of this interesting volume is enhanced by eight maps showing the extent of the Dominion at various periods in its eventful history.

Occasional Essays on Native South Indian Life. By STANLEY P. RICE, Indian Civil Service. London, New York, and Bombay: Longmans, Green, and Co., 1901. Pp. vi + 233. *Price* 10*s.* 6*d.*

From this volume we are glad to find that another member of the Indian Civil Service has begun to do for some parts of Southern India what Mr. Crooke of the same service is doing so well for the North-Western Provinces. Mr. Rice sets forth in a too brief series of sketches some of his observations of the people of Orissa and some others of the less generally known parts of Southern India, and recounts in simple but felicitous style some of their folklore and traditions. It was a happy thought also on his part to rescue from the limbo of the *Calcutta Review* his vigorous and spirited account of the rebellion of Palakimedwi, which, some sixty or seventy years ago, caused a very unwonted excitement to the benighted presidency. We trust that this volume is only the precursor of others in which the vast subject of the ethnology, folklore, and traditions of Southern India will be adequately and systematically treated.

A Short History of English Commerce and Industry. By L. L. Price. London: Edward Arnold, 1900. *Price* 3*s.* 6*d.*

The object of this useful and well-written compendium is "to give a brief account of the commercial and industrial development of England from the earliest times to the reign of Queen Victoria." A short chapter is devoted to a recapitulation of what is known of the economic conditions of England before the Norman Conquest, after which we have a sketch of the manorial system as gathered from the Domesday Survey, and an interesting notice of the commerce and industry of towns. The same incision of subject is pursued from the time of the Plantagenets to the Tudors with special reference to the industry in wool. The mercantile system which prevailed under the Tudors receives due notice; the effects of monopolies, poor-laws, alterations of the currency and the like are pointed out; and the economic revolution inaugurated by England's appearance after the Armada as a naval power of the first importance is forcibly described. An interesting chapter is devoted to the agricultural and industrial revolution of the last half of the eighteenth and first half of the nineteenth centuries, comprising notices of the improvements in agriculture and industry owing to inventions of machinery, the use of steam, the change to factories in place of domestic production, factory legislation, and the rise of trades-unions. The change of public opinion in the direction of free-trade is set forth, and with the introduction of free-trade the history ends. The writer lays no claim to originality of thought or research. His modest aim, and one in which he is very successful, seems to be to provide an introduction to more elaborate works like those of Cunningham and Ashley, and as such it is well worth a perusal.

The Passing of the Empires. By Professor Maspero. Edited by Professor Sayce. Translated by Mr. M'Clure. London: Society for Promoting Christian Knowledge, 1900. *Price* 25*s.*

The Preacher of old has said, "Say not thou, What is the cause that the former days were better than these? For thou dost not inquire wisely concerning this." If in the present time there is any one who wishes to inquire wisely into the question of the weal or the woe of the former days from 850 B.C. to 330 B.C., he cannot do better than study this stupendous work of Professor Maspero, in which he concludes his gigantic task of the compilation of a *History of the Ancient Peoples of the Classic East.* To those of our readers who have perused the preceding volumes, viz., *The Dawn of Civilisation* and *The Struggle of the Nations*, this volume needs no recommendation. Written with the perspicuity and impartiality of Hallam, and with the dignity, but without the ponderousness, of Gibbon, it rivets the attention of the reader from beginning to end. The subject, though ancient, is still fascinating, and fraught with many a lesson even to us of the twentieth century after Christ. The blessings and the dangers of peace are, we might think, very obvious and well known to us, but we rise with a better knowledge and a fuller appreciation of them, when we have read this history of five centuries when the sole, or at least the principal, use of peace was to prepare for war. We mourn the loss of some thousands of killed and wounded and prisoners in our last war, and we are right to do so, but how insignificant are these figures when we read of the booty of the generals of Sennacherib, in a single campaign, viz., "208,000 prisoners, both male and female, 7200 horses, 11,073 asses, 5230 camels, 80,100 oxen, and 800,500 sheep," besides tens of thousands of men and citizens put to death in battle or deliberately by tortures of the most revolting description.

The empires whose story is so vividly told by Professor Maspero are the Assyrian, the Median, the second Chaldæan, the Iranian, and the Egyptian, down to the time when Alexander the Great first appears on the pages of history His work, like its predecessors, is an imperishable monument of skilful erudition and patience, and it is with a sigh of regret that we learn that since the first volume was published, discoveries by excavation in Armenia, Babylonia, and Egypt have shed such fresh light on the tangled and complicated subject that "many pages of the volume will have to be rewritten in the light of them; such is always the fate of the historian of the past in this age of rapid and persistent research." This volume is splendidly illustrated from the remains in the British Museum, and the collections of the Louvre, Athens, etc., and from such well-known works as those of Layard, Leipsius, Place, and others. It has also several useful maps.

The Story of the Uganda Protectorate. By General F. D. Lugard, C.B., D.S.O. London: Horace Marshall and Son. *Price* 1*s.* 6*d.*

This *Story of the Uganda Protectorate* by General Lugard is one of the best of the "Story of the Empire" series. So far as the Protectorate is concerned, its history is short, for it was proclaimed only in August 1894, and the first Commissioner arrived only in June 1895. But General Lugard has added a brief account of its curious traditions and of what was told of Uganda by such distinguished travellers as Speke, Grant, Emin Pasha, etc., and the half of the book consists of an interesting description of the country, its population, manners, customs, produce, etc. It has already had its baptism of fire in the shape of wars between Protestants, Catholics, Mohammedans, and Heathens, but now, as the key to Central Africa, we may hope it will soon "take its place as one of the most progressive and valuable of the outlying dependencies of the British Empire."

In the South Seas. By Robert Louis Stevenson. London: Chatto and Windus, 1900. Pp. vii+343. *Price* 6*s.*

The many admirers of R. L. Stevenson will be glad to welcome this reprint of the South Sea Island sketches, which came out originally in *Scribner's Magazine*. They deal with Stevenson's first voyages there in 1888 and 1889, and give us his first impressions of hitherto practically unknown scenes, which probably he alone of all men of his time was competent to depict. The Marquesas and Paumotus of the Eastern group were the first to be visited, and after them the Gilberts. Slight as the sketches are, they serve to reveal to us the character and power of the writer. Truly a child of nature himself, he owed it to this that he was able to understand and inspire with confidence the savage children of nature with whom he came in contact, and yet he was often in positions of danger requiring dauntless courage, cool judgment, and prompt decision, qualities in which he never failed. Gifted with unusual powers of sympathy and humour, he was the favourite of chief and commoner, missionary, bishop, and cannibal, men and women, and he reproduces for his readers such lifelike portraits of those he met, that we seem to see them before us and to hear him speak to them. So also with his descriptions of the configuration and scenery of the South Sea Islands, their flowers, their forests, their animal life. The veriest trifles are invested by his pen with an interest and wonder which rivet the attention of the reader and hold it undiminished throughout. To such of our readers as have not seen these sketches as they appeared, we heartily commend this volume.

The History of Colonisation, from the Earliest Times to the Present Day. By Henry C. Morris. 2 vols. New York: The Macmillan Company. London: Macmillan and Co., Ltd., 1900.

When we say that Mr. Morris, the writer of these two volumes, is an American, we have indicated their *raison d'être*. In the introduction he tells us that his interesting work "is in a certain measure the satisfaction of a personal need," and that the problem has arisen "whether the United States was to become a colonial power." Further on he tells us that his object is to state the historical and economical facts of colonisation "impartially and without bias, fairly and without prejudice, so as to enable the reasoning reader to formulate in any instance his own independent judgment. The effort will be strenuously made to supply concisely the data from which conclusions may be deduced, in order that he may be able to determine the best methods as well as the effects of colonisation, not only upon the lands thus peopled and governed, but also upon the nation undertaking such an important labour." We may at once congratulate Mr. Morris on having produced a most interesting work, in which he has fairly succeeded in attaining his object. We have here a calm and impartial review of the history of colonisation from the first dim traces of it in the annals of Egypt, some twenty-five or twenty-six centuries before the Christian era, down to the end of the nineteenth century after Christ. The first part of the work deals with the colonisation of the Egyptians, the Phœnicians, the Carthaginians, the Greeks, and the Romans; the second part deals briefly with the mediæval Italian republics and oligarchies which attempted something in that direction, viz., Amalfi, Pisa, Florence, Genoa, and Venice; the third part deals in much greater detail with modern colonisation, viz., that of the Portuguese, Spanish, Dutch, French, and English; indeed, practically the whole of the second volume is devoted to the chequered story of English colonisation, which, for reasons obvious at least to American statesmen, demands more careful consideration and more detailed statement and discussion than the others. In treating so vast a subject, the author must have necessarily, though he has not apparently, been hampered by the superabundance of the materials and authorities which bear upon it. He has wisely eschewed overloading his work with statistics, but there is a sufficiency of figures, judiciously arranged by subject and by period, so that the reader carries away a comprehensive view of what has been laid before him; and the numerous notes, indicating the sources of information from which the work has been compiled, show that Mr. Morris has spared no labour or trouble to acquire a complete, accurate, and impartial command of his subject. Even in his brief account of the Hispano-American war, without which this book would probably never have been written, he maintains a calm and judicial attitude, and seems much more impressed with the new responsibilities undertaken by his country than by the success of the American arms. Referring to the annexation of the Philippines, he says, "A new problem arose, perhaps more vital to the conqueror's than to those whose allegiance was so unexpectedly transferred; the solution of the many perplexities involved in the possession and management of this group (of islands) will long require the gravest consideration on the part of the wisest statesmen present and to be." His words regarding the miserable policy which lost for England, but gained for the world, the United States, are in equally good taste. "It does not come within the province of this treatise to detail the immediate causes of separation arising from existing conditions; the events which occurred are too well known to bear repetition. All are familiar with the succession of oppressive measures; how the Stamp Act of 1765, the six duties, the tea tax, the closing of Boston harbour, the

resolution of Virginia, and the approval of the other colonies led to the meeting of the Continental Congress and the Declaration of Independence. Eulogies of the heroism of America's forefathers would be vain. The nation was born; and English colonisation matured into the greatest political fabric ever created." We sincerely trust that this important work will receive across the Atlantic the patient and attentive study it so thoroughly deserves. It is sure of a most cordial welcome and appreciation here, as a valuable contribution to the study of a difficult subject, which notwithstanding all our past experience, demands our constant attention, for the simple reason that England now recognises that she is only the heart of Greater Britain, that what wounds her colonies wounds her, and what helps her colonies helps her.

New Lands: Their Resources and Prospective Advantages. By HUGH ROBERT MILL, D.Sc., LL.D., etc. London: Griffin and Co., Ltd., 1900. Pp. xii + 280. *Price* 5*s.*

This is a welcome addition to our library of applied geography, and a very different type of book from the ordinary volume applied merely to the idosyncrasies of an examination syllabus. The work is a brief treatise on the economic geography of temperate lands where the white man is likely to settle, or where our countrymen have large financial interests. Dr. Mill has had exceptional opportunities of becoming acquainted with current literature and of gaining information from travellers of all kinds, and his book is an admirable critical summary of facts. Theoretical considerations are not tabooed, but have been collected into two introductory chapters, the gist of which members read in the *Magazine* for March 1900, in the article on "The Development of Habitable Lands." In the accounts of different lands Canada comes first, and rightly receives the fullest treatment. Dr. Mill's personal acquaintance with the country makes his chapters at once more interesting and more weighty. As an illustration of the up-to-dateness of the work we may cite the account of the Cape Nome gold-fields; and as an instance of Dr. Mill's faculty for selecting salient facts we may quote the story of the Argentine Government changing an order for £1,000,000 of war material to the same value in steel rails and rolling-stock on concluding an agreement to arbitrate with Chile. The economic conditions of South Africa are very sanely treated, and those who are attracted towards it, yet know nothing about the country, will do well to read attentively Dr. Mill's chapter. While much land has been opened up during the past century, much remains to be broken up: and where governments are sufficiently intelligent the geographer and other scientific men will be consulted as to the limits and best methods of profitable exploitation.

A Lifetime in South Africa. By SIR JOHN ROBINSON, K.C.M.G. Being the Recollections of the first Premier of Natal. London: Smith, Elder, and Co., 1900. Pp. xxxix + 418. *Price* 10*s.* 6*d.*

A native of the mother-country, Sir John Robinson proceeded at an early age to Natal as a member of a family of settlers, and, having staunchly thrown in his lot with his fellow-colonists, he worked his way onwards, attaining ultimately the honourable post of first Premier of the colony. Hence he may be justly regarded as the best type of the later Natal pioneers; and his interesting and able volume of reminiscences will be welcomed by all.

As a patriotic Natalian, identified with his colony alike in failure and success, much of his book is naturally devoted to its domestic affairs, and mainly from a historical point of view—and it must be admitted that its history during the past

half century here dealt with has been a most restless one. The author relates the early proceedings of the Legislative Assembly, of which he early in life became a member, together with its struggles, under considerable difficulties, to maintain due form and order in accordance with the highest British constitutional authorities, with considerable humour; but when the difficulties which beset the colony from every source, as here set forth, are fairly considered, few will deny that the colonial representatives set an example of courage and resource which is well worthy of recognition. In this respect, at least, Natal has in the past set a worthy example —the ready co-operation on the part of the colonists and their representatives with the Crown authorities on all occasions when their loyal assistance was required; and in this connection it is pleasing to find Sir J. Robinson offer their due meed of praise to former governors and public men, such as Sir Benjamin Pine, Sir Bartle Frere, and others, whose merits, though too often at the time clouded over and depreciated, are now brought to light, that thus their memories at least may receive due respect and honour.

But passing over thorny points such as former difficulties with the Boer "Voertrekkers," and the native question, which occupy a good deal of the book, the geographical interest rests chiefly on the extension of the colony itself, through which difficulties have arisen with the adjacent Cape Colony. It must indeed be admitted, from a mere glance at the map, that the extraordinary zigzag outline which has been imposed from without upon the colony of Natal is an indication of something unsatisfactory. The frontier is by no means a "scientific" one; and the explanation of all this the author sets forth in a succinct and lucid manner, claiming that Natal has throughout, in her dealings with her neighbours, received but a scant measure of justice. Thus a good deal of attention is directed to the district of Kafirland, including the territories of the Galekas, Pondos, etc., which the author describes, probably with considerable truth, as "perhaps the fairest region of South Africa." The disputes with the Cape Colony Government as regards this region are most likely in great part due to the peculiar geographical configuration of the country, with its succession of short rivers flowing in a parallel course to the sea from the mountainous interior. But Sir J. Robinson may be trusted to faithfully set forth the case for Natal.

The volume is written in a hopeful strain, though in the midst of the yet unfinished war, in which Natal has bravely borne her part; and though the author confesses to "a constitutional tendency to look at the brighter side," we may willingly share his expectations. Altogether, the work is one which may be commended to every class of reader.

Aux Colonies d'Asie et dans L'Océan Indien. Par G. Verschuur. Paris: Librairie Hachette et Cie., 1900.

We gather from the concluding sentences of this book that it is written for the purpose of enlightening the French nation with regard to the true condition of their colonies in the East, and the causes which have brought them to their present unsatisfactory position. To assist his readers in this investigation the author describes some of the English and Dutch colonies, and contrasts their administration and success with those of the French colonies. In this enterprise, as laudable as necessary, Monsieur Verschuur is merely following in the footsteps of several of his compatriots, whose works we have reviewed on many occasions, and his observations and strictures are on well-known lines. He has no new observations to offer, and no new plan of administration to suggest, and so it is to be feared he will suffer the same fate as his predecessors, and find himself merely *vox clamantis in deserto*. He puts his finger without difficulty on the two principal errors of the

French system, viz., intolerable customs restrictions, and incessant changes of administrators—the one strangling commerce and the other preventing colonial officers from ever acquiring even a superficial knowledge of the countries they are intrusted to govern. To these faults he adds the laxity, or worse, with which officers for the colonies are chosen, the absence of special training for their duties, the insufficient pay they receive, and the excess of leave, which enables them to revisit, at comparatively short intervals, their beloved Paris, from which they return to the East with reluctance and repugnance. Some of his figures and remarks, indeed, might awaken even a French bureau and give it cause for reflection. "Le fonctionnarisme dans les colonies françaises est poussé à outrance; il est pour le développement du pays ce que le phylloxera est à la vigne. Une statistique que j'ai eue sous les yeux m'a montré qu'en Cochinchine et au Cambodge on trouve 1706 fonctionnaires pour 212 agriculteurs, industriels et commerçants européens. Combien de postes inutiles et de sinécures ruineuses arriverait-on à compter dans le nombre? Au Tonkin et en Annam pour 447 colons (les marchands de sardines et de vermout compris, bien entendu) il y en a 1396! Est-ce étonnant qu'un journal cochinchinois ait publié pendant que je me trouvais a Saïgon: 'Le sol de l'Indo-Chine est très favorable à toutes sortes de cultures. Le fonctionnaire y vient très bien et le douanier y pousse à l'état sauvage.'"

Monsieur Verschuur's tour in the East was extensive, including Bombay, Singapore, Saïgon, Cambodya, Annam, Tonkin, Canton, Shanghai, Japan, Java, Mauritius, Réunion, Madagascar, and Zanzibar. He did not leave the beaten tracks, but his descriptions are fresh and bright, and never wearisome. It is evident that he saw much which he admired in the English administration of our eastern colonies, but it seems impossible nowadays for a French author to write a book about the East without a sneer at England. Duplicity, hypocrisy, and selfishness are imputed to us without hesitation, although we might expect that the freedom and prosperity of our colonies, and the cordial welcome which settlers and traders from all nations receive, would effectually dissipate such notions in the mind of a careful eye-witness. But in discussing the future of China M. Verschuur disfigures his book with remarks like these, "L'Angleterre, dont l'amitié est une signature gravée sur un glaçon, s'est emparée de Wei-Hai-Wei et saisira le premier prétexte venu pour s'arroger une nouvelle tranche du gâteau." Later on he says, "Les Anglais, toujours prévoyants, ont depuis 1886 un traité avec le sultan de Socotora, qui place l'île sous leur protectorat. De là à une prise de possession en règle, il n'y a qu'un pas à faire, l'île pouvant constituer une station importante sur la route des Indes. Voilà pourquoi John Bull y débarquera bien un jour, la bible d'une main et la bouteille de whisky de l'autre, pour civiliser les indigènes." Against prejudice and misrepresentation like this there is no remedy, except to treat it with the indifference and contempt it deserves.

In Tuscany. By Montgomery Campbell. London: John Murray, 1901. Pp. xvii + 355. *Price* 9*s.*

In this pleasantly written work the author discourses with much enthusiasm on some of the less-known highways and byways of Tuscany, where he has long resided, and which he knows right well. Although a heretic, *i.e.* a Protestant, he is an avowed admirer of monks and friars, and he is seen at his best in his glowing descriptions of Monte La Verna, with its holy memories of St. Francis, or the Passionist monastery of Monte Argentario. The first part of the work is given up to clever sketches of Tuscan character and life, and these are followed by

descriptions of Leghorn, Lucca, Pisa, Volterra, and Elba, which are treated very differently from what we find in Baedeker or Murray. The book is abundantly enlivened with historical incidents, local traditions, and personal observations, which secure the attention of the reader, and provide a welcome variety of interest. The illustrations are of pictures not usually accessible to ordinary readers, and there is a good map.

Sur la frontière Indo-Afghane. Par A. Foucher. Paris: Librairie Hachette et Cie., 1901.

This work does not pretend to be one of geographical research; it is rather intended for the archæologist or student of Buddhist remains. During two years, between 1895 and 1897, M. Foucher made an expedition into North-Western India, *i.e.* into the tract that lies north-east and north-west of Peshawar, under the auspices of L'Académie des Inscriptions et Belles-Lettres of Paris, and the work now before us is a *réchauffé* of his notes and of articles published elsewhere. He went over no new ground, and his expeditions in search of Buddhist remains seem always to have ended in failure, because he went to places the treasures of which had been removed, or as he would call it, rifled by amateur collectors or by officers of the Public Works Department of the Government of India. Thus even for the archæologist there is little or nothing new to be learned from this work. On the other hand, it is a pleasantly written account of a delightful tour in a very interesting country. The author as usual received every facility and courtesy and much hospitality from British officers wherever he went, which he very heartily acknowledges. His sketches of some incidents of frontier campaigns are lively and clever, and it is a welcome pleasure to come across a volume written by a Frenchman, dealing with a part of our Eastern empire, in which there is neither a sneer nor a reproach against England.

Mes Grandes Chasses dans l'Afrique Centrale. Par Édouard Foá. Paris: Librarie Plon. Plon, Nourrit et Cie., 1901. *Prix* 10 francs.

Apparently this work by M. Édouard Foá, which we reviewed in June 1895, has lost none of its popularity in France, for a ninth edition has been called for and is now before us. This volume, *Mes Grands Chasses*, we are told, is merely a reproduction of Vol. I. of *Les Chasses des grands Fauves*, and is worth reading as a vivacious and graphic account of two or three years' sport in South Africa some years ago, when big game was more plentiful than it is now. The excitement and dangers of the sport lose nothing in the telling of M. Foá. The work is well illustrated, and contains many useful hints and much information, which even now will be of value to any one who cares to follow M. Foá's example.

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ENGLAND AND WALES. Bartholomew's Reduced Ordnance Survey. Scale 2 miles = 1 inch. Sheet 23—Hereford. Sheet 13—Derby and Notts.

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SCOTLAND. Chart No. 1403. West Coast. Loch Ryan. Surveyed by Staff-Captain W. F. Maxwell, R.N., 1898-99.

The Hydrographer, Admiralty.

AFRICA.

AFRICA, Investor's and Newspaper Reader's Pocket Map of ——. *Price* 1*s. coloured*
W. and A. K. Johnston, Edinburgh and London.

EGYPT. Aufnahmen in der Östlichen Wüste von Ägypten. Von Georg Schweinfurth. 1 Serie (10 Blätter). Zweite Lieferung, Blatt 4 und 5, 1900.
Dietrich Reimer, Berlin.

AMERICA.

UNITED STATES, Geological Atlas of the ——. Folios of **Colorado**, Ten Mile District, Telluride, Elmoro. **Montana**, Butte, Little Belt Mountains, Fort Benton. **Washington**, Tacoma. **Tennessee**, Wartburg, Standingstone. **Wyoming**, Absaroka. **California**, Truckee, Sonora, Bidwell Bar, Big Trees. **Massachusetts—Connecticut**, Holyoke, **Oregon**, Roseburg. **Kentucky**, London, Richmond. **Idaho**, Boise. **Virginia**, **West Virginia**, Tazewell. **Texas**, Nueces.

UNITED STATES Topographic Atlas. Physical Geography of the Texas Region. By Robert T. Hill. Folio 3. *U.S. Geological Survey.*

POLAR.

SPITZBERGEN. Océan glacial Arctique. Spitzberg (Côte N.O.). Baie Red. Plan levé en Juillet et Août 1899, à bord de la "Princesse Alice," commandée par S. A. S. Le Prince Albert 1er de Monaco. Par M. Guissez, Lieutenant. Échelle au $\frac{1}{50,000}$. *Presented by H. S. H. The Prince of Monaco.*

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ATLAS UNIVERSEL DE GÉOGRAPHIE. No. 24—Italie. No. 40—Russie, orientale, et Caucasie. No. 44—Asie politique. *Librairie Hachette et Cie, Paris.*

ATLAS DES COLONIES FRANÇAISES. Dressé par ordre du Ministère des Colonies. Par Paul Pelet. Livraison 3. (Afrique occidentale. 1 Sénégal, Congo, Polynésie.) Livraison 4. Madagascar, partie centrale (2 sheets). Inde, Guyane. *Armand Colin et Cie, Paris.*

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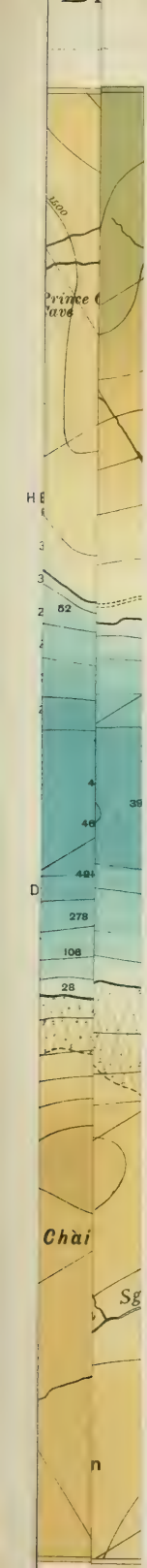
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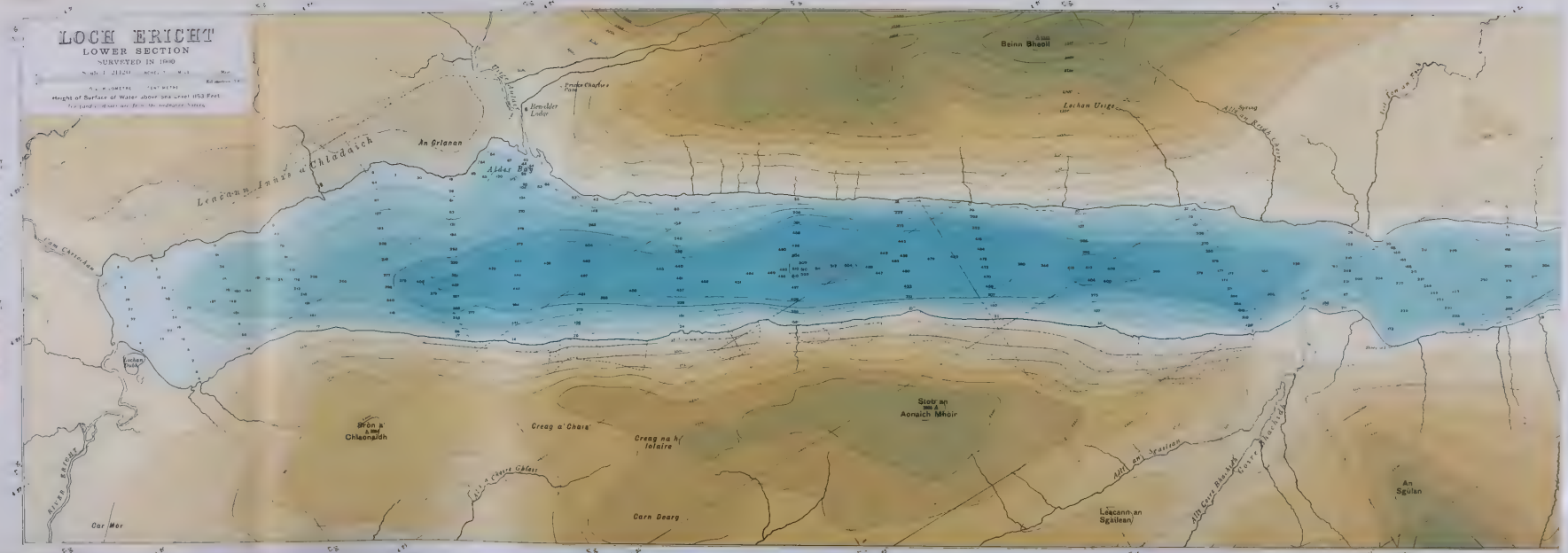
PLATE I

Bathymetrical Survey of the Scottish Lochs.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., and FRED P. PULLAR, F.R.G.S.



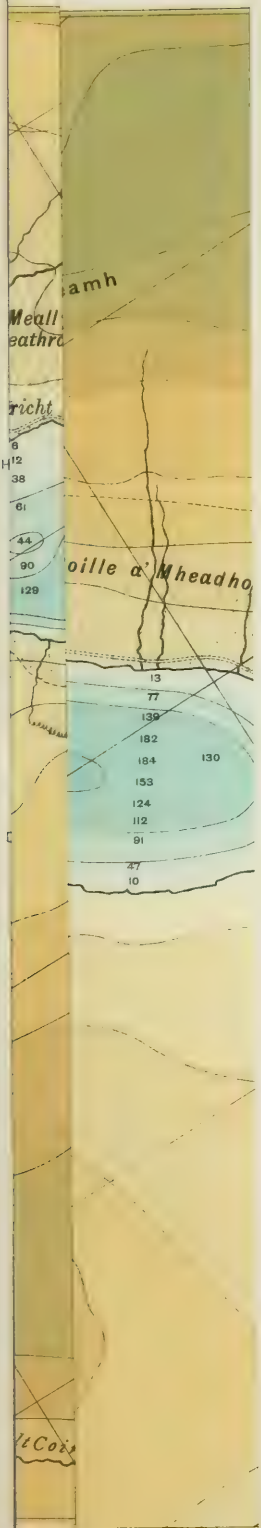

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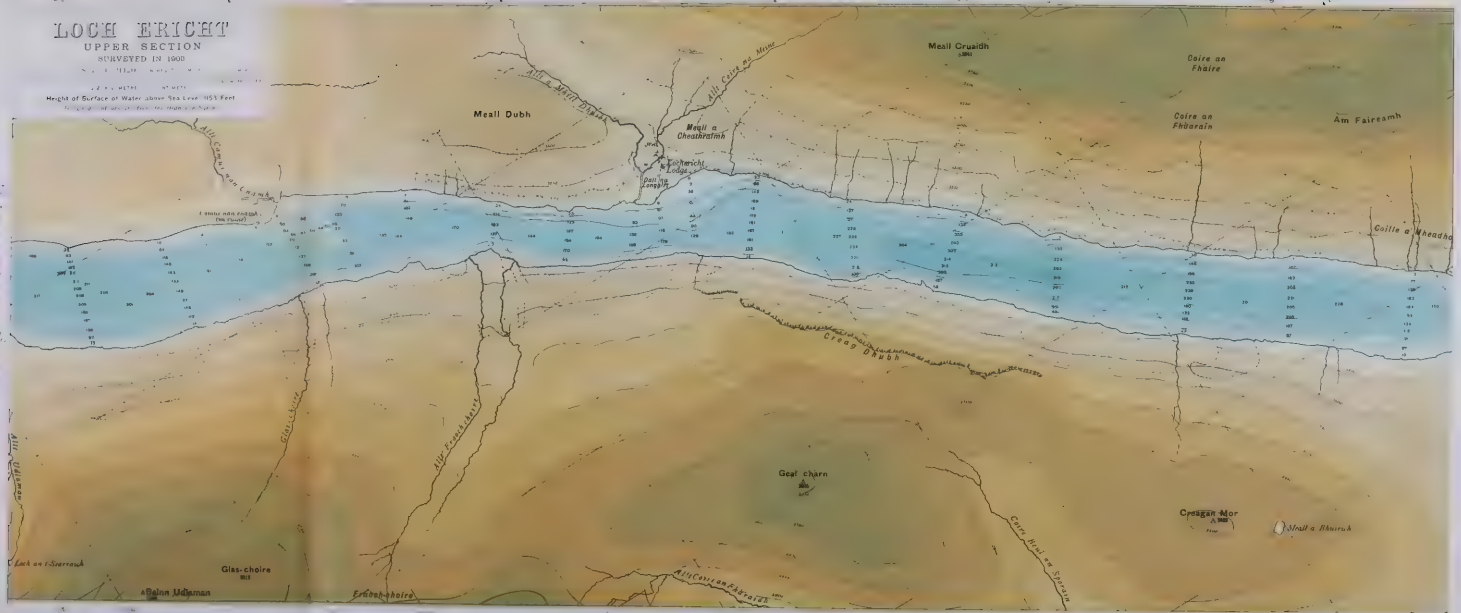
PLATE II

BATHYMETRICAL SURVEY OF THE SCOTTISH LOCHS.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., and FRED P. PULLAR, F.R.G.S.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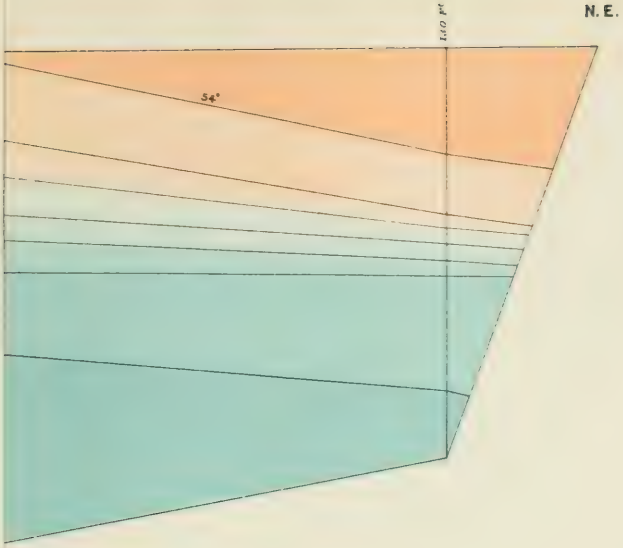

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BATHYMETRICAL SURVEY OF THE SCOTTISH LOCHS.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., and FRED P. PULLAR, F.R.G.S.

LONGITUDINAL SECTION

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SHOWING THE DISTRIBUTION OF TEMPERATURE AS OBSERVED

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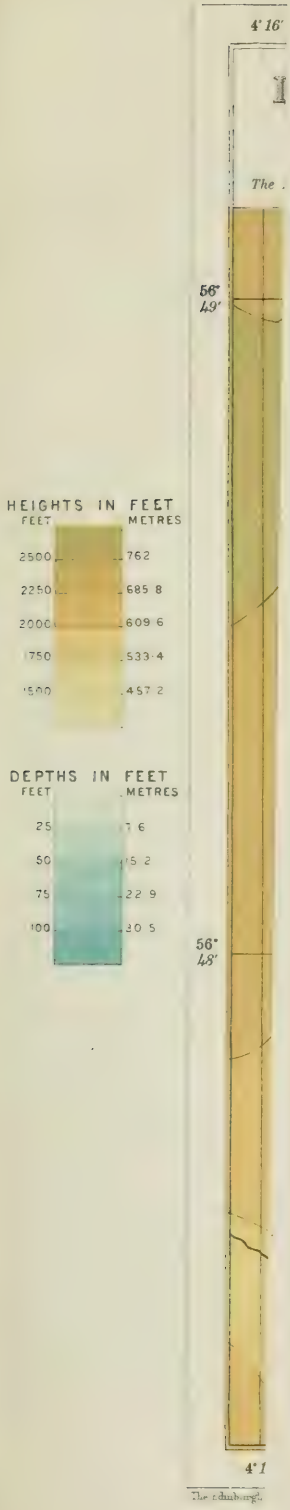
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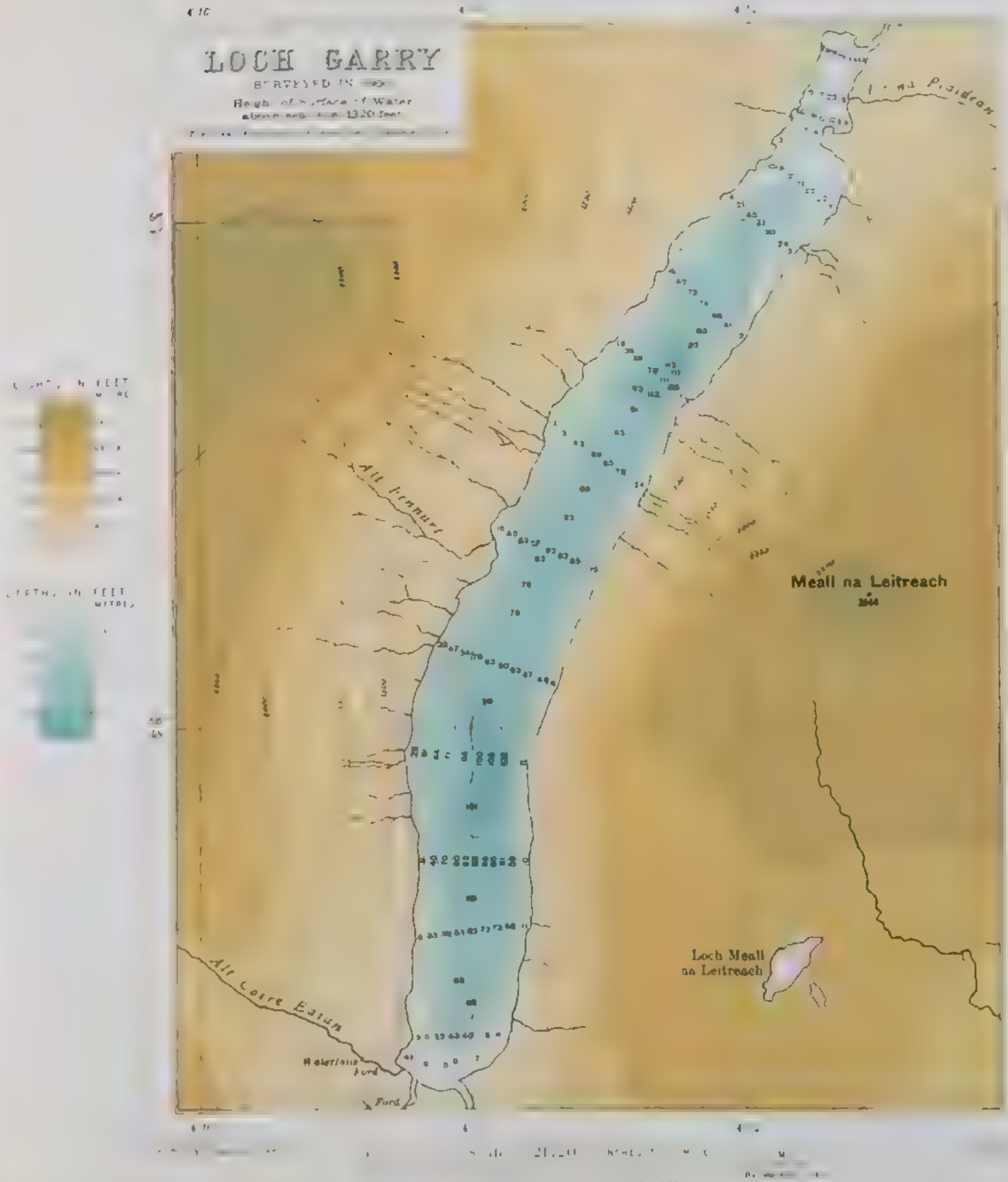
PLATE IV

Bathymetrical Survey of the Scottish Lochs

By Sir John Murray K.C.B. LL.D. F.R.S. and Fred P. Pullar F.R.G.S.



THE SCOTTISH GEOGRAPHICAL MAGAZINE.

RAILWAY CONNECTION WITH INDIA.

By Sir T. H. Holdich, K.C.I.E., C.B.

With the rapid development of Russian railways in Central Asia and Siberia, the intermittent progress of lines of internal communication in China, the realisation of modern schemes in India, which will gradually cover that country with a complete network of commercial and military railways, and the certainty of a connection between existing systems in Asia Minor and the head of the Persian Gulf—public attention must necessarily become more and more concentrated on the possibility of reaching India overland from the great commercial centres of Europe. The reason why English interest in this matter has never been acute is doubtless that it is so easy to reach India by other routes which are not overland. We already possess a magnificent sea service, and a magnificent navy to protect it. We are not forced into inhospitable waters and wide spaces of unproductive country; nor have we to take up the burden of creating a commerce to sustain a railway which is essential to our national development in the East, like Russia. Were there an open Arctic sea and an easy line of ocean communication between the White Sea and Vladivostok on the Pacific coast, it may well be doubted if the Siberian railway would have ever been called into existence, in spite of the abnormally favourable geographical conditions which support it; for commercially, steam communication by land can never compete with steam communication by sea as a means of transport for bulky produce. Besides this there are other considerations, both political and military, which have weighed (perhaps more heavily than they should do) against any development of open lines of communication with India, the ends of which, and the protection of which, are not absolutely in our hands. About such considerations I can have but little to say at present. At present I only wish to point out that with the rapid development of railways over nearly all the productive area of Asia, it will eventually

be found impossible that one comparatively small space of country (which is certainly not unproductive) should remain undeveloped in their midst—that one comparatively short link which is required to connect two vast and complicated systems of land communications should remain unforged, for either political or military reasons alone. Direct railway connection between Europe and India is certain to be established sooner or later, and it is therefore a matter of more than passing interest to examine the geographical conditions of those countries and districts which intervene, which must govern the general principles of its alignment. The special conditions which would be favourable for such a scheme as the linking up of Europe and India are in many respects different from what they were some twenty, or even ten, years ago, and they are continually changing. Mechanical science has advanced so far, that railways are now made to run where railways were previously impossible; and in the realms of what we may call strategical geography we have learnt very much lately that still requires to be straightened out into axiom and precept, all of which has a most important bearing on the approaches to India. But the general features of favourable geographical condition remain unchanged in spite of special modifications in the conditions of alignment. We must still study the strike and the altitude of the main mountain ranges, the orography and hydrography of the regions to be traversed, and still make an exhaustive study of the land surface by means of technical surveys, if we would avoid the penalties that invariably attend the process of jumping to conclusions in the matter of alignment. The scientific study of the countries which lie between Europe and India has not been by any means exhaustive, but it has made great advance during the last twenty-five years; and we at any rate are now positively assured of certain geographical facts which limit the area of technical investigation to very narrow bounds.

Right across Asia, from NE. to SW., through the great central region of inland drainage, from Bering Strait to the north of Afghanistan, and thence curving north-west to the southern shores of the Caspian and Black Sea, there runs a band of central highlands. This band is flanked to the east by the great Turkestan and Mongolian depression—a region of desert and salt lakes—which is again parted from northern India by the vast mass of the Tibetan tableland, edged on the north by the Kuen Lun and subsidiary ranges, and on the south by the Himalayas. The Russians have found a way across this great central divide, passing round the southern shores of Lake Baikal into the head of the Amur basin which turns the northern end of the Mongolian deserts. And there may be other passages across it of which the mere altitude would not forbid the construction of a railway, but no such railway could by any possibility be aligned in the direction of India. For the present we may consider the great Tibetan highlands and its flanking ranges, as well as the vast uplands of the Pamirs, as quite beyond the pale of serious consideration so far as any opening for railway extension towards India from the north is concerned. West of the Pamirs we find the Hindu Kush and the apparently complicated mass of elevated mountain ranges diverging therefrom southwards presenting a further barrier,

which is, indeed, only secondary to that of the Himalaya in its impracticable nature and rugged obstructiveness. And indeed, we may hunt along the whole range of the Hindu Kush to its western roots in the mountain masses which divide northern Afghanistan from southern, and still fail to mark any possible opening for a continental line of railway. We are here dealing with altitudes of over 12,000 feet, with perpetual barriers of ice and snow. Through the northern Afghan highlands, the Koh-i-Baba, the Firozkoh plateau, the Band-i-Turkestan, we are still faced by an impenetrable wall. During the process of surveying these elevated wilds we found mountain tracks, indeed, in abundance, tracks running from side to side across the water-parting which were enough to serve the purposes of purely local traffic; and here and there the Hindu Kush is intersected by roads and passes which are open to the passage of slow-moving kafilas, converging on the great central mart of Kabul. But there was nothing which, in the present stage of mechanical advance as applied to railway construction, favoured the possibility of carrying an open line through such mountain barriers as these, nor is it possible to conceive of any future principle of railway development that will deal successfully with the raging storms of wind and snow, the avalanches of mud and stones, the intense fierce cold and the bitter experiences of a winter climate that hitherto, for untold ages, has rendered these mountain regions uninhabitable for many months of each successive year.

But as this great Asiatic water-parting trends westward, and passes through the districts that lie to the north of Herat, its conditions change considerably. Here it assumes the form of a comparatively low range, composed of material soft enough to be largely influenced by the action of wind and weather, worn into rounded peaks and hillocks, which sweep down to the lowlands in long, well-graded spurs. To this part of the divide we have given the ancient and classical name of Paropamisus, a name which more accurately should be applied to the Hindu Kush, but which has found a convenient, and we hope a lasting resting-place on the summit of this northern watershed of the Herat valley. So easy of access and so fertile are the grass-covered slopes of the Paropamisus, that wheeled vehicles can be driven across it in some parts without even the preliminary necessity of road-making. It is actually pierced and parted by the Hari-Rud—the river of Herat—which, rising not far to the west of Kabul in the uttermost highlands of the Hazara country, runs a straight course westward in a long narrow valley, passing the walls of Herat to the south, and finally bending northwards near Kuhsan, it divides the Paropamisus backbone, and rushes through a picturesque series of mountain gorges out into the open plains of Turkestan. Westwards, beyond this passage of the Hari-Rud, the great continental watershed again assumes the conformation of a rugged system of mountain chains, forming, not one, but a whole series of walls and barriers, right athwart the course of existing roads and projected railways to the south, and thus it continues through northern Persia to the regions of the Caucasus and the Black Sea. Through this western part of its extent I will not follow it, partly because I am unacquainted with that part,

and partly because it is here beyond the reach of direct British political influence, and is likely to remain so.

There is but one geographical opening leading from the northern regions of the Aralo-Caspian depression—the region of Russian interest and Russian railway enterprise—to northern India. From the southern shores of the Caspian Sea to the tableland of western Afghanistan about Kandahar, one may pass by the Hari-Rud opening without encountering a single obstacle of the nature of a mountain pass, without ever negotiating any considerable gradient even, provided the alignment curves sufficiently southward to embrace the agricultural districts of Farah, whence it would pass by easy stages to a culminating altitude at Quetta, of about 6000 feet above sea. This route never drops to a lower level than that of the Herat valley—say 2500 feet. This, then, is the one highway to India which is rendered feasible by the geographical conformation of the districts intervening between the Caspian and the Indian frontier. Eastward of it there is, in my opinion, no alignment practicable for railway construction till we reach China and the possible Burmo-Chinese connection.

We will now consider what there may be to the west of the Hari-Rud, or Herat, gateway.

The great plateau or table-land of Persia, like most of the table-lands of Asia, is fringed on its northern and southern edges by mountain ranges, forming, as it were, a protecting rim or barrier, of which the general conformation is but a repetition of what we find in the Kuen Lun and the Himalayan systems fringing the plateau of Tibet, or the Hindu Kush and the Sulaimans, what equally bind the edges of high Afghanistan. Whatever may have been the nature of those vast natural forces which ranged the Himalaya and our Indian frontier mountains into a compact band of ridge and furrow, with long, narrow, serrated ridges folded and bent into parallel flexures like the waves of the sea, with long trough-like valleys intervening, the main ranges being split asunder, or cracked across, to admit of main drainage channels, those forces have obviously affected the whole of South-west Asia more or less equally, and with analogous results. From the head of the Persian Gulf, through southern Persia, Makrán, Baluchistan, Afghanistan to the Himalaya, the tectonic principle—the system of construction—is the same, whatever the geological conditions may be. But whilst our western India frontier is broken here and there by curves and bends in the general strike of ridge and furrow which occasionally admit of the passage of a river from the highlands to the plains which has not to carve its way from side to side of any gigantic ridge (as, for instance, the Puráli river, which forms a most admirable line of approach to Kandahar from the corner of the Arabian Sea), the configuration of the Persian hills seems to be more regular, and to offer fewer opportunities for outflanking, or for directly crossing, them. Obviously a conformation of mountains ranging east and west, such as this, is especially favourable for railway making from western Persia to India, inasmuch as the general alignment of the railway would follow the general alignment or strike of the mountain ranges; and especially unfavourable for any projected line from northern

Persia, or from the stations of the Trans-Caspian line of railway, to the shores of the Persian Gulf. To put it shortly, if we want to reach India from western Persia we have but to follow up the long lateral valleys between the crests of ridge and plateau, and we should never cross any divide or watershed that partakes of the nature of a mountain barrier; whilst if the Russians wish to reach the shores of the gulf from the north they have at best nothing but open columns of such barriers to face, and perchance the necessity for encountering them in a serrated mass of close formation. Judging from the accumulated evidence which a wide system of geographical map-making has placed in our hands, no less than from personal observation, I should say that it would be incomparably easier and cheaper to run a line from Western Persia to the Indian frontier than it would be from Mashhad direct to Bandar Abbas, or from Tehran to Bushire. And yet the geographical difficulties in the way of the Indian line through Persia are considerable, as I will proceed to show. Commencing then with the assurance that east of Herat there is no way open to railway construction on account of the natural obstruction offered by great mountains and high altitudes, and that west of Herat we must adapt our line to the accidents of geographical conformation if we would successfully avoid such obstructions, we will proceed to consider what alignment connecting the head of the Persian Gulf with the west of India is likely to support a productive railway.

One alignment which has been suggested, and which has already received some consideration in scientific circles, is that which would connect Basra with Karachi by way of the Persian coast and the northern shores of the Arabian Sea.

Independently of engineering difficulties and the cost of construction, there appears to me to be certain commercial and climatic objections to such an alignment, which would in themselves render it almost prohibitive. The long, low foreshore of the Persian coast is usually backed by rugged bands of mountains, which leave but a narrow space between their outer ridges and the sea. Where these mountains recede from the coast the width of intervening flat is often so low as to be lost in swamps and morass. There are no harbours, excepting that which gives access to Bushire—a harbour with a difficult entrance and a dangerous bar—and there are but few ports connected with the interior by road. Linja and Bandar Abbas are indeed trade ports of some significance, but they possess no harbour—nothing but an open roadstead, which under certain conditions of weather affords but a risky anchorage: and the roads which at present connect these ports with the interior of Persia are of the very worst possible description, barely meriting to be called roads at all. Even the high-road from Bushire to Shiraz is but a very indifferent mule track. To the east of Persia, along the coast of Makrán, there are at present no ports (although there are harbours) which possess sufficient commercial importance to be included in the visiting list of the British India Company's steamers. Trade developments would undoubtedly follow a railway, but throughout the length of the line from Basra to Karachi, the three ports of Bushire, Linja (possibly), and Bandar Abbas, are all that can at present be considered as of any commercial significance.

The climatic conditions which govern the Persian and Makrán coasts are of course variable, but for four or five months of the year they can only be regarded as insufferable. The intensely humid, vapour-bath atmosphere of the gulf in the summer months makes life a burden to those telegraph officials who are compelled to face existence wrapped round with its pernicious influence, and it is but indifferently balanced by the fresh clear skies and breezy seas of the too short winter season. There is also the objection that a coast railway line would be brought into direct competition with the gulf steamer traffic, and under no consideration, neither that of bulky goods traffic, or of passenger conveyance, does it appear to me that it could ever compete with the sea-line. With a comparatively fast service of steamers from Basra to Karachi the main objects of a railway would be defeated, and such a steamer line will be the natural sequel to the railway terminus at Basra. It is true that in following a coast line we are conforming to the general principles which fit a railway to the formation of the country and lead to fewest natural obstructions, but still the engineering difficulties would be considerable. From Basra to Bushire a railway would inevitably have to skirt the low flats of the Euphrates and Karún deltas, and turn inland so as to tap the commercial resources of Ahwaz. Four great rivers—the Shat-el-Arab, Karun, Kurdistan, and the Tab—would have to be bridged in the first 300 miles of this alignment before reaching a point from which a branch could be carried to Bushire. In the next 400 miles, between Bushire and Bandar Abbas, several more shifty, expansive, and troublesome rivers would have to be negotiated, but beyond this ever recurrent necessity for bridging, there would be few engineering difficulties. There is indeed an alternative line between Basra and Bandar Abbas to be found on a higher level parallel to the coast, inland—a line which occasionally approaching within twenty miles of the coast, touches several large inland towns such as Ram Hormuz, and is lifted well above the heat-ridden atmosphere of the sea-board. No great engineering difficulties would attend such an alignment, as it passes between ridges following the general strike of the mountain system, and encounters no formidable transverse watersheds until it approaches Bandar Abbas. This is a line which might certainly claim the promise of paying its way locally, and it would be in all respects a superior alignment to that of the actual coast, always provided that the descent by the Sarzeh gorge from the highlands to Bandar Abbas proved feasible after technical examination. Neither alignments would actually touch the port of Linja, which is shut off by a wide stretch of swampy country from the hills behind. When, however, we leave Bandar Abbas to strike eastward to India, the route is beset with difficulties. All this intervening country has been fairly well surveyed, and it is safe to assert that no high level line is possible between Bandar Abbas and Jashk (say, for 200 miles), and that once again our railway would have to take to the flats bordering the coast. Once again we should be face to face with the incessant necessity for bridging the innumerable rivers and streams which carry the drainage of a narrow strip of mountain country to the sea. For 500 miles east of Jashk to Urmara, a railway approximating to the Indo-

Persian telegraph alignment might be practicable; but near Urmara there occurs a great natural obstruction, of which I am not prepared to say that it could be surmounted. The Ras Malan thrusts out into the ocean a gigantic headland with sheer cliffs 2000 feet in height towering above the ceaseless surf of the Arabian sea, and these cliffs are backed and bound by a mass of mountains which not only extend far inland, but for some sixty miles farther east towards India offer a physical block to railway enterprise of such intricacy that, with all the advantage of a comparatively close survey of them, I cannot say in what way a successful crossing might be engineered. The last 140 miles of coast route to Karachi, touching Sonmiani and crossing the Hingol, the Puráli and the Hab (all rivers of importance), presents no impracticable obstacle, and indeed might be termed an easy section of the line but for the bridge-making. Taking the alignment as a whole, we have at least 1600 miles of line passing through a district which is, as yet, undeveloped, and which can never develop without roads to supplement the railway; which enjoys the reputation of simmering perpetually in one of the worst atmospheres in the world; and which possesses at least one obstacle to engineering which may be pronounced impracticable until full technical examination can be made. There is the further and final disadvantage that it competes, on almost impossible terms for success, with a sea service which is already established, and is capable of much improvement.

I think, then, we are justified in setting aside the coast-line project as a desirable enterprise. Persia, however, is a wide country, and we need not necessarily look to the coast as affording the best prospects for railway evolution.

For an average width of about 200 miles inland from the coast line all western and southern Persia, as well as southern Baluchistan, is more or less densely packed with mountains, the conformation of which, as I have already endeavoured to explain, is that of a system of parallels and approaches, rising by successive steps to the central region of inland hydrography, but itself intersected and traversed by lines of drainage which, winding and twisting through the infinite complexity of subordinate mountain spurs, or cleaving asunder the axis of the main ridges, finally reaches the ocean. So that within this band of mountains no longitudinal alignment is possible which does not encounter in a greater or less degree each successive stream or river which drains that area. If, instead of dealing with the coast, we were concerned with the future of a Grand Trunk line through Central Persia, linking up Tehran Ispahan or Kashán with Yezd and Kirmán, the physiographical conditions of the line would be much altered. It is a geographical fact no less remarkable than that to which I have referred in pointing out that from the Caspian to Kandahar, or by way of Herat, one may pass through a generally mountainous region without encountering any obstacle in the nature of a formidable pass, that from the extreme west of Persia to Kalat and Quetta, or even to Karachi, it would be equally possible to indicate an alignment which would never cross a difficult watershed or ascend a mountain side. Regarding this as a Persian line,

and setting aside for the present the difficulty of bringing Tehran, Kashán or Ispahan into connection with European systems either at the head of the Persian Gulf or on the Caspian, it is a line which promises such important local developments, throughout the very heart of Persia, it is so favourably placed as regards the important accessories of climate, and geographical position, it would be so cheaply constructed, and withal so rapidly, that it is impossible to believe that in the ordinary progress of Asiatic commercial evolution it will not sooner or later figure as the great central line of Persia. Such a line as this, could no doubt be readily connected with the Indian systems. South-east from Kirmán, a way is to be found between the Jamal Bariz range and the Kirmán desert to Bam and Bampur, which leads into the long narrow level valleys of the Mashkhel and Rakshan, hugging the mountain slopes indeed, but never actually facing them, and terminating either at Kharan, on the way to Kandahar, or at Kalat and Quetta, with no worse obstacle to overcome than a rough but short cross-country section between the head of the Rakshan and the Kalat plateau. Not only does this line encounter no formidable difficulties in the shape of passes across important water-partings, but it traverses no important water-channels, and no deserts, but runs an even course through a cultivated and in many parts a rich and prosperous part of Asia. It is bound to be one of the important lines of the future, and, consequently, one of the political problems of to-day is whether in the final adjustment of political influences in Persia, the construction of that central line is to fall to English or to Russian engineers. Geographically speaking there is little throughout its entire length which requires more exact technical information than that which we now possess to assure us of its easy alignment. That little lies chiefly in southern Khorasan to the south-east of Kirmán—but as there are two or three Russian survey parties, and at least one English survey explorer, already in that region, we shall surely be sufficiently well informed ere long. But, as I have already pointed out, the difficulty of connecting a Central Persian line with any European system to the north or west is a very serious one. It is impossible at present to indicate any satisfactory alignment that might connect it either with the Caspian on the north, or Basra on the south, or even admit of branch lines to Bushire or Bandar Abbas. Here we at once encounter all the physical obstruction presented by a compact band of mountain ranges directly traversing such an alignment, an obstruction which has hitherto rendered the reputation of Persian roads that of the worst system of trade communications in the eastern world. To say that such connections are impossible would of course be absurd, seeing that they possess none of the crowning difficulty of vast altitudes; but they would possess more than all the disadvantages which beset such mountain lines as now exist between Jacobabad and Quetta—disadvantages which still render the Harnai and the Bolan loops of the Sind Pishin railway a source of constant anxiety; and which might possibly turn them into a source of weakness at some critical period of our history in India. But such a central line would undoubtedly relieve Bushire and Bandar Abbas, (I do not include Linja because the

Linja trade is chiefly a local pearl trade) of the greater part of that inland trade which still finds its painful and difficult way across the sea-board hills to the coast, and turn it into Indian channels. Of the local success of such a line there can be no reasonable doubt, but for the present it can hardly be advanced as a prospective link between Europe and India.

We may turn now from Persia to that central opening at Herat to which I have already alluded. Whilst employed on the Russo-Afghan Boundary Commission both as surveyor and reorganiser of the defences of Herat, I had ample opportunity for studying that special link between East and West which has been so much in men's minds of late, and which must inevitably occupy public attention yet more closely in future. The problem of connecting Europe with India is clearly not to be speedily solved in Persia. Geographical considerations, which means in other words financial considerations, will block the way for many a year to come, even were we assured of our political position with sufficient certainty to declare that we would construct a railway in that country. But here, between Herat and Kandahar, or rather between the Russian terminus of Kushk and the British terminus of New Chaman, we have a short 500 mile project offered to us of such favourable nature as we may assuredly look for in vain elsewhere. It is indeed so plain and simple a project that it has not escaped the attention of even the most elementary critics of our Eastern position, and we may be certain that its value and its possibilities have been reckoned up with all care by the governments both of Russia and of India. Consequently a few words about the geographical surroundings of such a line may be interesting from a purely original source.

From the Russian station of Kushk to Herat is roughly a distance of sixty-six miles, and midway is that great Asiatic water divide which, insignificant as it may appear when represented by the rounded crests of the Paropamisus, can be traced east and west right across the continent. The one gateway through it, which is formed by the passage of the Hari Rud river, is considerably to the west of Herat, and the direct connection between Kushk and Herat is by the Ardewán pass—a pass which is so little formidable to engineering projects that it is improbable that the circuitous route which takes advantage of the gorges of the Hari Rud would be adopted in preference, even for a railway. For that part of the distance which lies north of the Paropamisus the grade is but a gentle ascent over the smooth slopes of the Badghis uplands. Here indeed is no great wealth of villages and population, but there are nevertheless many narrow valleys and gentle hill-sides which are full of cultivable possibilities, and have ever afforded good grazing. I should think it probable indeed that fifteen years of security has brought about considerable changes already in the wind-swept, but always smiling, "chol" of Badghis. Kushk is about 2000 feet above sea level, and the pass of Ardewán about 4800. The soft broad back of the Paropamisus widens somewhat about this pass, so there is a twisting course of some seven miles ere the road leading down from the pass emerges from amongst the foot-hills at Kush Robat. Here we

are 3900 feet above sea. Sixteen miles on a slight downward grade over the gravel formations of the "dasht" carries the road to a populous town called Parwána lying at the back of a subsidiary range which forms as it were the southern edge of the "dasht" uplands. It is this secondary ridge (called the Mulla Khwaja) which you may see to the northward from the Herat walls, and not the actual Paropamisus, which is hidden by it. A nullah bed with a wide and winding course of eight miles intersects the Mulla Khwaja and opens a passage into the Herat valley, where within the last six miles there is an extensive system of irrigation canals to be crossed, and much close cultivation. Herat is 2600 feet above sea level. Three miles south of the town the Hari Rud river is crossed by the Malun bridge, and beyond that river southward through Sabzawar and Farah to Kandahar, for 360 miles more, there is no obstacle to railway engineering that is worthy to be called "serious." The exit from the Herat valley turning the Doshak ridge at its eastern extremity presents no difficulties of grade, and thenceforward through the indefinite Perso-Afghan borderland we have to deal with an open rolling country of scrub-covered "dasht" (or sandy uplands), alternating with flats of gravel and sand, but sparsely supplied with water and ribbed here and there with the black craggy streaks of isolated ridges which nowhere offer any continuous or formidable obstacle to a fair alignment. This part of Khorasan has been sometimes described as desert, but it is a mistaken application of the term; the desert lies farther west. Water is scarce, but the sources of water-supply have been hitherto undeveloped, and the actual waste spaces where no agricultural or pastoral acres exist are but comparatively small. There are at least two walled towns which can lay claim to considerable commercial importance in western Afghanistan — viz. Sabzawar and Farah—and many large and important villages lie between Sabzawar and northern Sistan (somewhat to the west of Farah) which are centres of large areas of cultivation and of local industries. Amongst them are Zakin and Kang and the interesting little town of Anardara perched in the recesses of one of the transverse and rocky ridges of which I have spoken, the centre of the carpet industry of Adraskand. Pasturage is in most parts abundant, and the staple product of the district as a whole is undoubtedly wool. Between Farah and Girishk on the Helmand (assuming that our line turns eastwards from Farah leaving Sistan to the south) there are 150 miles presenting rather more doubtful facilities for railway purposes than the rest of the line between Herat and Kandahar, which is well known and mostly surveyed. Here the connecting alignment between these two places traverses the strike of the long spurs which form the ultimate foot hills of the Hazara uplands, which trend downwards towards Sistan from north-east to south-west. But so far as we can see, it skirts the extremities of these spurs although it strikes across their successive lines of drainage which here carry their waters southward. The bridging of the Helmand at, or near, Girishk is the one important feature of the line. Taking it as a whole it may be said that there are no formidable engineering difficulties to be encountered, but there are three large and

somewhat uncertain rivers to be bridged (the Farah, Adraskand, and Helmand) all three being liable to heavy floods. There is an irregular distribution of populous and fertile districts interspersed with waste spaces, but quite enough of it to ensure the success of the railway as a local venture independently altogether of its value as a link between Europe and India, if we may judge by our own experiences in Sind and the Panjab, and by those of the Russians in Siberia. Whilst considering the local possibilities of a line in western Afghanistan we must not overlook the influences of the extension of Russian systems in the north. Of more significance to India than the Baghdad concession is the project of a direct connection between the Trans-Caspian system and the Central railways of Russia. The effect of the proposed alignment from Alexandrof-hai, where the Ryazan Ural railway now ends, almost in a straight line to Kungrad, Khiva, Charjui and Merv, has already been ably dealt with by Mr. R. Long in the *Fortnightly Review* for December 1899. It enables troops to be sent from "Moscow to Merv in a hundred hours, and from Warsaw in less than six days," and apart from these strategical advantages, it outflanks the passage of the Caspian and offers the enormous advantage commercially of a direct line to Merv involving no break of bulk in transit. Into this Russian frontier aspect of the question we have no time to enter further, but I understand that within the last twelve months considerable modifications in this alignment have been proposed. I can but record my opinion as a surveyor and geographer on that part of the scheme which immediately concerns our own interests in Afghanistan and Persia. Here at least I can claim the advantage of original and independent observation.

Whilst I have endeavoured to emphasise the geographical advantages of a European connection for India *viâ* Herat rather than by any long, expensive, and undesirable route which might be found on the Persian coast, I can hardly leave the subject without a brief reference to some of the more weighty objections which have been urged against the linking up of Kandahar and Kushk. First, politically, it is often said that under no conceivable circumstances would the Amir be induced to grant a concession for such a line. To press the matter to an issue might even lead to a war with Afghanistan. It is a curious illustration of the influence of geographical position on international policy that the little semi-barbarous kingdom of Afghanistan, hemmed in between two gigantic civilised Powers, as it is, and possessing no natural barriers to free intercourse on either side, should be able to maintain a position of conservative independence of outside influences which neither China nor South Africa have been able to secure. And it is not difficult to understand the reluctance of the Amir—who studies European papers and is well aware of the practical effects of the extension of European influence—to the introduction of the outlander or any of his works. But in Afghanistan, as in China or South Africa, there can be no final barrier maintained against the expansion of civilisation. If England and Russia were agreed on the point, the Amir would certainly have to give way; and to those who have studied the idiosyncrasies of the Afghan mind there is little doubt that a concession in western Afghanistan is but a

matter which might be included within the pale of political financial arrangements. Nevertheless, as the political aspect of the question is one which bears precedence of all others so long as our present relations with Afghanistan remain undisturbed, it may be well to emphasise its importance. The disadvantage, if not the danger, of breaking in upon the sanctity of the Afghan "buffer," of arousing suspicion or fanatical opposition amongst the border people of Afghanistan, with whom we are now on terms of neutrality, is not lightly to be regarded, nor is it lessened by the fact that these Afghan races spreading north-westwards from Kandahar towards Herat include what have always been reckoned as the most fanatical and dangerous of those clans who belong to the true Afghan, or Durani, community. It must be remembered, however, that certain sections of these very same people have already been brought under the British flag by the recent demarcation of the Afghan boundary, and it is a curious fact that where this demarcation has cut across Durani territory there was none of that actively fierce and determined opposition which was aroused by the boundary demarcations of the north. So far as I know, these new recruits to the population of British Baluchistan have accepted the new order in quiet contentment, and prove to be peaceable, if not always desirable, neighbours. Chiefly, however, it is important to note in this connection that the proposed line of railway lies on the extreme west of Afghanistan—so far west and so near to the Persian frontier for the greater part of its alignment, that it would be a stretch of imagination to regard it as an invasion of Afghan territory such as would in any way weaken the solidity of the now united Afghanistan under the central government of Kabul. And there is one other point which requires consideration. I have already referred to the difficulty that must attend the construction of any line connecting Mashhad on the north with the Persian Gulf on the south; but if it is a question of Sarakhs on the north and Sistan on the south much of the difficulty vanishes. In other words, instead of constructing a connecting link with Russia through Afghan territory alongside the Perso-Afghan border, it would be very possible to construct it on Persian territory alongside the same border, but shifted, as it were, to the other side of the hedge. Such a line would connect the Russian line at Tejend with Sarakhs (361 feet), and, passing through the Hari-Rud gorges about Zulfikar, would cross over the hills bordering the district of Hashtadan on the west into vast intervening spaces of flats and open plains to Yazdan (2313 feet), and so, by the Chah Sagak pass, leading across the tail of a low intervening range (about 4000 feet) it would run through the Birjand district to Sistan. There is no great engineering difficulty to be apprehended on such a line; there are no difficult rivers to cross in open, sandy, shifting beds; no mountain ranges barring the way with lofty altitudes. There is the Hari-Rud series of gorges between Sarakhs and the point at the elbow of the river where the Perso-Afghan frontier line leaves it, and there is a certain amount of rough, sterile, hill country in Birjand, as well as two distinct watersheds rising to some 2000 or 3000 feet above the plains on either side, to be surmounted. Without special acquaintance with topographical details,

we know enough to be aware that such obstacles as would be encountered are far from formidable, and offer no comparison whatsoever with the difficulties presented by a line from north to south between Mashhad and Bandar Abbas. The difficulty lies in Sistan, and this difficulty is the recurrence of those far-spreading periodic floods, which, occurring in certain phases of the Helmand's rise and fall, occasionally isolate Nasirabad (the capital of Sistan) from the world to the north, west, and south, and render communication almost impossible for months together.

Various projects for connecting Sistan and Quetta by rail have already been broached, but unfortunately the recent Afghan boundary demarcation has given away to Afghanistan the one available line of approach which offered the most certain foundation for a permanent alignment. In appraising the value of the Sistan trade too much has perhaps been made of the actual productiveness of the Sistan province, and too little of the opportunities afforded by eastern Persia through Kirman. It is well known that a new trade route (or rather a very old trade route under a new form) has been opened up between Kirman and Quetta through the Helmand desert. To those who regard the eastern Persian trade as of possibly apocryphal value, it may be sufficient to point out that the first kafila venture to Quetta, which has happily already paved the way, has rewarded its supporters to the extent of 17 per cent. of interest on the original outlay. But I am not advocating a Sistan railway, nor yet a connection between Sistan and the Russian system through Persia. I only wish to emphasise the fact that if the political difficulty of an easy line through Afghanistan is to be considered conclusive, there is an alternative which presents no great difficulties if we can only see our way past the Helmand floods.

Not much less serious is the objection of military experts to the construction of a line which would at once offer a strategic highway from the Russian border to India. But here there are many considerations which have not, I think, as yet been fully weighed. We have only learnt quite lately much about the value of single lines of railway in supporting a military advance in strength, and what we have learned has certainly not increased our appreciation of their value. A single line of railway from Herat to Kandahar would never (so far as we may be permitted to judge from South African experience) support a sufficient force to deal adequately with the strong defensive positions which would be found at the Indian end of it, even if the initial difficulty of the break of gauge between Russian and Indian systems were successfully dealt with. On the other hand, the opening up of a railway means the opening up of the country generally, the development of water supply and of roads, and the increase of facilities for advance independent of the line. No one supposes that the Russian line to Kushk (which will soon be supplemented and possibly extended) is constructed for commercial purposes. It is there to support Russia's position on the Afghan frontier, and in a less degree her position on the Chinese frontier also. It is, in short, meant for strategical purposes, and it constitutes already a menace to India. But if we leave western Afghanistan alone, that menace does not disappear. It would only be affected in degree, and I for one

think it doubtful in what direction it might be affected by free intercommunication. With Mr. Long, I am inclined to believe that political difficulties between Russia and India would be lessened by free intercourse and commerce between the two countries, that the more we know each other the better we shall appreciate the legitimate aims and aspirations of each, and the less likely we shall be to come into collision. I speak from a certain amount of personal experience when I say that whatever may be the state of international rivalry between the two countries, personal animosity (which is occasionally only too apparent in other parts of the continent) is entirely wanting in Russia; but perhaps the really aggressive section of the English travelling public has not yet made itself felt quite so far afield.

Would the construction of a railway between Kushk and Kandahar involve any great military responsibility in addition to that with which India is already burdened on her frontier? Would it be necessary to maintain more troops and to occupy further military stations than those which now exist? I fail to see that either would be necessary. It is often airily stated by those who know little or nothing about the capabilities of defence which are possessed by Herat, that the Russians could move across the Paropamisus and occupy the fortress and the valley, as matters now stand, without any effectual resistance being possible to their advance. There were many who thought much the same of an advance to Pretoria not so very long ago. We must remember that times are changing. New weapons have to a great extent modified old methods. Irregular organisation is no longer necessarily a bar to successful defensive tactics, and there is nothing that I know of in Herat to prevent a well-sustained defence of that fortress by troops which possess as much discipline as those of the Amir's army, provided they make the best use of such weapons as they already possess, and are properly led. But however that may be, it is clear that a railway would strengthen rather than weaken that position without the addition of a single Sepoy to our frontier force, by placing within our reach a means of rapidly concentrating troops from India in the direction of Herat, should it be necessary to act so far in advance of our own frontier. Were any scheme proposed which would have the effect of rendering the frontiers of India and of Russia conterminous, undoubtedly more troops and more frontier posts would be necessary. But there is no suggestion of any such scheme in a Kushk-Kandahar railway. It does not even open a *new* line of advance to Russia. It merely improves an existing one, and whilst the fact of the break of gauge between Russian and Indian systems would certainly hamper the conditions under which Russia might essay to make use of it as a military line, no such difficulties would trouble the Indian Executive, who could make it infinitely more effective in the cause of defence than Russia could in the cause of aggression. But I hardly see why such considerations should preponderate in our councils, or why we should persist in regarding Russia as ever eager to perpetrate the folly of an attempted invasion of India whilst she still has such vast and unmanageable tracts of Asia on her hands to occupy her attention and her troops. I look on an invasion of

India as such a remote and improbable contingency that the consideration of it may very well be set aside for the discussion of the more practical question whether such a line would pay. Here again we encounter a variety of opinion amongst experts.

I cannot now enter into any detailed account of the productions and developments of western Afghanistan, pastoral and agricultural. There is nothing to prevent the districts with which we are now concerned from becoming prosperous, if not rich; and so far as I know there is no officer who is personally acquainted with these districts who does not agree that a local line would pay its way, quite independently of through traffic. The question as to which way the local traffic in wool and wheat would flow is an open one. Colonel Yate (who has had the best possible means of studying the question) thinks it probable that the wool of Baluchistan and western Afghanistan and the wheat of Sistan would find its way northward to Russian markets. I do not altogether agree with him, for I believe that, besides the burden of Russian transit dues, the necessary break of bulk at Kushk (involved by break of gauge) would be a final barrier to northern export. We should more probably take much of the commerce of Eastern Persia away from Russia, and secure to ourselves all the local traffic of the country through which the railway passes from Herat to Kandahar; and I think that the Russians are themselves prepared for this. They, on the other hand (whilst possibly congratulating themselves on the possibility of a more open line for a military advance), look to the English Government contracts for the mail service and the first-class passenger traffic to make the connection pay; and I am assured on the high authority of a great Russian engineer who is well acquainted with the country that these assets alone would repay them amply for the prospective loss of certain commercial advantages in Persia. It is, at any rate, the commercial and not the military aspect of the question which will decide when this line shall be constructed. That it will be constructed finally there can be no shadow of doubt, and in my humble opinion the construction of it will make more for peace and goodwill amongst the nations than any system of peace conventions which could possibly be inaugurated.

A SAIL DOWN THE IRRAWADDY.

By Henry M. Cadell of Grange.

In any one special characteristic the Irrawaddy may no doubt be easily surpassed by other great rivers, but I venture to think that few, if any, of the explored waterways of the Old or New World can be said to display for 1000 miles such a varied combination of interesting and attractive scenes, and are so well fitted to appeal to the traveller's taste, whether it be for sport, antiquities, scenery, geology, ethnography, natural history, or commercial geography. Far grander gorges than those of Upper Burma, no doubt, wall in the marvellous course of the Colorado river

of the West, but these profound cañons traverse for the most part a waste variegated wilderness of arid sand and naked rock, almost destitute of vegetation and the traces of human handiwork. The banks of the Mississippi, on the other hand, though fruitful and busy, are mostly flat and featureless, and, like those of the Amazon and other great American rivers, are quite innocent of historic ruins and ancient monumental buildings. The Nile valley, again, in its lower reaches at least, is a classic museum of antiquities, but in other respects it resembles the Colorado minus the cañons, and traverses a flat, rainless desert, without vegetation or striking scenery to relieve the dry landscape. The bosom of the busy Volga swarms in the summer season with fleets of steamers and huge barges of merchandise, plying between the populous towns and poverty-stricken villages of the sad Russian steppes, but as for scenery it is here conspicuous by its absence. From Nijni Novgorod and the head waters of the famous river, down to its delta in the blue Caspian Sea, the Volga crosses a more or less dismal plain, with a dun-coloured cliff on the right bank, above which the country sweeps away to the horizon with slight undulations, and on the left a low flat expanse, partly cultivated and partly in a state of jungle, with few or no outstanding scenic features to relieve the dreary monotony of the depressed and depressing picture. The Ganges, again, rolls its turbid flood through a vast fertile plain, teeming with Oriental life and sprinkled with ancient cities and the splendid memorials of a hundred generations; but here, too, there is still something lacking. After once leaving at Hardwar the portals of its glorious Himalayan birthplace, this noble river has an exceedingly tame and monotonous course over a tawny plain expanding to the skyline with almost perfect horizontality.

The Irrawaddy has none of these "buts" to detract from its character. It has a little, if not very much, of each of the good qualities of a great river, and every traveller with any sort of taste at all—beyond that for his dinner—will, between the months of October and May, find something congenial to it here. If he be a sportsman, there is plenty of game, both large and small, roaming or roosting in the jungle, or swimming in the rolling flood. If an architect or archæologist, the endless variety of pagodas, palaces, temples, kyaungs, and monuments in the recent and the deserted cities, of every degree of style and state of preservation, are sure to arouse his enthusiasm. If a biologist or ethnologist, there is a wide field for investigation in the abundant fauna and flora, and in the numerous interesting races of Burma and the Shan States. If he have a turn for geology or mining, the country has its undeveloped mines of coal, precious stones, gold, and other valuable ores, with oil-wells, interesting fossiliferous strata, petrified forests, curious mud volcanoes, and many other objects waiting to be explored. The artist in search of the picturesque will, among the fine natural scenery, the abundant ruins, and the easy-going, good-natured, and friendly people, find scores of charming original subjects for his brush, and the economist or large-minded empire-builder who looks to the future, will in Upper Burma, with its thin population and undeveloped but fruitful tracts, see great possibilities for expansion and immigration from the more densely populated parts of our tropical Empire.

Into such a variety of topics, on each of which a volume might well be written, I have no intention of entering now. All I shall do is to reproduce a few sketches and notes made during a visit to Burma in the end of 1899, in the hope of interesting the readers of this magazine in a remote part of the Empire that deserves to be better known at home. What interested me may not appeal to others in the same way, of course, nor do I pretend to say that the objects I shall refer to are those most worthy of attention or most likely to prove interesting to any one who may, after perusing these lines, be tempted to pay the country a visit. The trade of Burma is, it may be mentioned, principally in the hands of Scottish merchants and companies, and therefore every brither Scot with a keen eye to the main chance may well be expected to take an interest in a region that has for a long time yielded good interest to many of his enterprising countrymen who have gone there in search of new outlets for their capital and their commercial energy.

The river is navigable all the way from Rangoon to Bhamo by large flat-bottomed paddle steamers, a distance of 1028 miles, and the palatial steamers of the Irrawaddy Flotilla Company provide every comfort that can reasonably be expected by Europeans visiting that remote province of the Indian Empire.

The lower part of the river-course between Rangoon and Prome runs partly over the delta among flat tracts of rice or paddy land, which though interesting is not particularly striking. At Prome 311 miles up from Rangoon, the country becomes hilly, and low ranges flank the river on either side, sometimes overhanging the brink in bold ridges, and sometimes receding to a distance of several miles beyond a flat alluvial plain, but at no place disappearing entirely from view all the rest of the way to Mandalay and Bhamo near the Chinese frontier. At Bhamo the river enters the higher hill-country, and is only navigable for boats and small steamers or launches, which run as far up as Myitchina, 140 miles above Bhamo, where the stream rushes and swirls along between rocky walls and wooded heights amid the striking scenery of the first defile.

The river was low when we reached Bhamo in December 1899, and the water was confined to a regular channel that had for the most part been excavated in the deep alluvium of the plain by the swiftly rolling stream. (Fig. 15.) The left bank at Bhamo is at that season a steep bluff twenty or thirty feet above the level of the water, but when the wet weather sets in a great deal of the surrounding country becomes submerged. Bhamo is a small town of about 9000 inhabitants, consisting chiefly of Chinese, Shans, Kachins, and a few Burmans. It is only about twenty miles from the imperfectly defined Chinese frontier, and is visited by numerous caravans laden with silk, walnuts, and other products of the Celestial Empire, which return with cotton grown in Upper Burma for disposal at the Yunnan market. The surrounding country is mountainous, and the plain is encircled on all sides by ranges of blue hills, partly bare and partly clad with jungle. The trees overhang the steep bluff below the town, and when the river is low it can be seen at certain places rapidly eating back its banks as it winds from side to side and continually shifts its course. Every now and then at such places a splash is heard,

and a wave circles outwards from the fresh scar in the cliff, as a large slice undercut by the current slips down with its matted covering of trees and bushes, and is swept away to form a new plain at a lower level. It is not always safe to hug the bank in a small boat where this process is going on. In some instances, if the alluvium is strong and coherent and free of thick jungle, the river undermines it so quickly that the cliff face begins to overhang and bow forward, falling outwards every few minutes into the water with a heavy splash in slices like massive walls pushed over in succession from behind. This phenomenon is far more conspicuous in the valley of the Indus where the river terraces are higher and the erosion of the banks is carried on by the swiftly rolling flood on a very much grander scale.

At Sinkan, a few hours' sail down from Bhamo, the hills draw near and the river leaves the densely wooded plain behind as it enters the

Fig. 1.—Entrance to the second defile.

stately portals of the second defile. (Fig. 1.) The channel which, below Bhamo, is, including the islands and sandbanks that subdivide it, sometimes a couple of miles in width, now narrows to 200 yards, and the river for several miles flows between steep rocky walls overhung by a dense jungle of small bushes and large forest trees of different kinds. (Fig. 2.) There are no regular rapids, but the navigation is very dangerous when the river is high, and the frequent turnings of the gorge produce swirls and eddies that can scarcely be passed at certain seasons. At places the water is extremely deep, and the bottom sinks from six fathoms to twenty and even twenty-seven fathoms in some of the pools. At the most picturesque part of the defile a cliff rises sheer out of the water to a height of 800 feet on the right bank, and at its base, on an isolated rock, the picturesque tapering pile of the Let-saung-gan pagoda may be seen amidst luxuriant trees overhanging the water, and producing a picture most striking in its artistic effect. (Fig. 3.) Not far from this spot

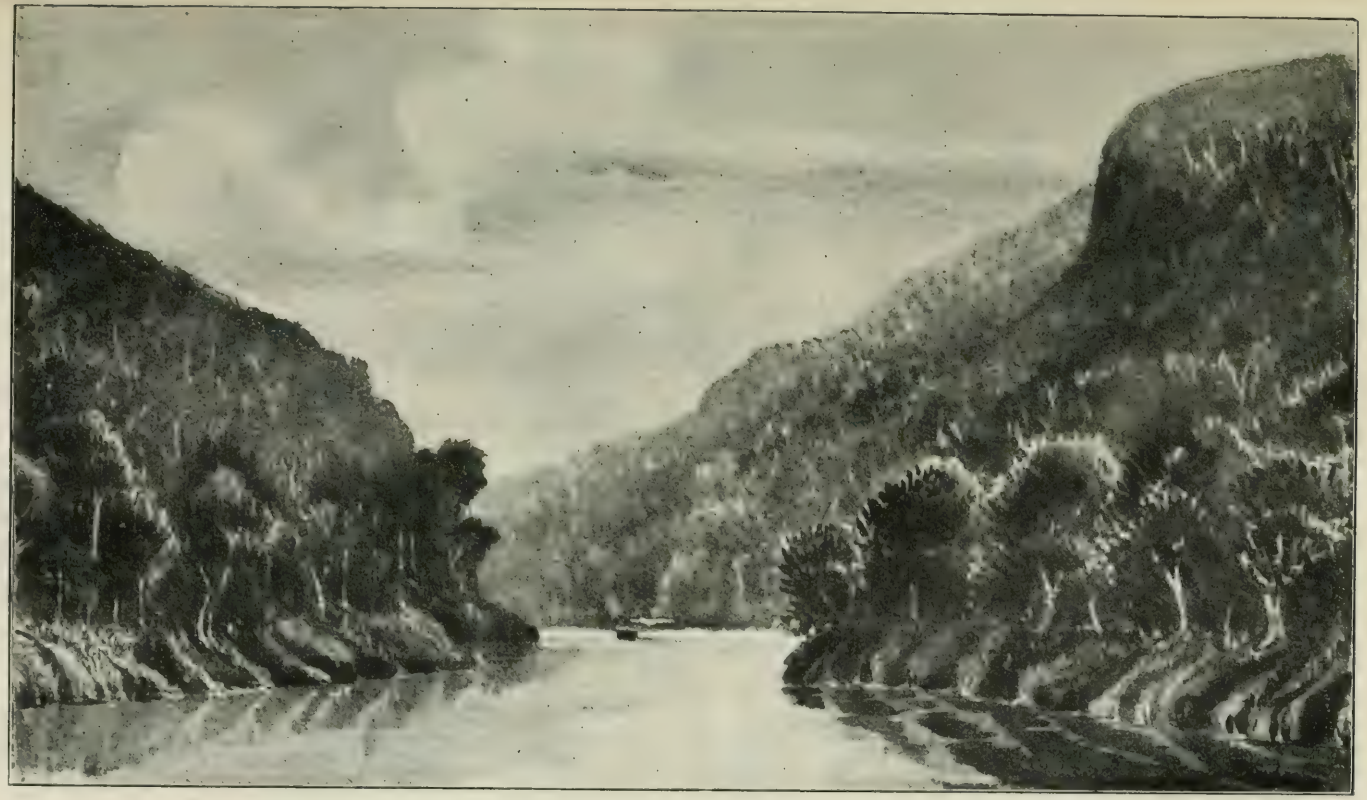


FIG. 2.—In the second defile, near the centre, looking up.

the remains of a sunken steamer can sometimes be seen. This unfortunate hulk is a remnant of the royal flotilla in the "King's time," and Thibaw, the story goes, ordered its captain to start at once and convey a detachment of troops down the river at a time when the water was dangerously high and rapid. The captain, who was responsible for his vessel, refused to sail, considering the passage of the defile too dangerous to risk just then, but the king would brook no delay, and peremptorily ordered the ship to sail at once, failing which her captain would be hanged. In these circumstances he had to choose between the devil and the deep sea, and he chose the latter, with which no doubt he was best acquainted. His ship was wrecked in the forlorn attempt, but with most of her passengers and crew he managed to reach the shore and evade Charybdis, but he was caught by Scylla in the form of the angry king, who had him promptly hanged for the loss of his steamer.

The hills not far from the river rise to a height of about 4000 feet, while the river itself is only about 300 feet above sea-level here. The running water has thus succeeded in cutting a notch 3700 feet deep across the mountain range during the course of its long history. The type of scenery in the second defile is illustrated in the accompanying sketches. (Figs. 2, 3, and 4.)

At Shwegu the river emerges from the gorge, and for 150 miles it winds amid snags and low islands over an alluvial plain bounded in the distance by hills, and partly cultivated, but for the most part covered with a growth of dense forest and almost impenetrable jungle. In the morning a thick white fog often overhangs the water, and until this clears navigation must be suspended. The pestilential vapours arising from the rank vegetation and moist soil make this part of Upper Burma very unhealthy for Europeans, and the village and station of Katha on the right bank, connected by a branch with the Mandalay and Myitchina railway, is noted for its poisonous miasma.

Below the second defile the banks become more populous, and many characteristic Burmese sailing-boats and dug-out canoes are in evidence plying between the small villages, whose houses, perched on legs, appear among the trees on either side. The Irrawaddy is fed by a large tributary—the Shweli river—which enters it a short distance above Tigyaing, and, flowing through the Shan States and the great teak forests of Upper Burma, acts as the highway for the transport of that valuable timber. Fleets of teak rafts stream down past Tigyaing, and the accompanying sketch (Fig. 5) shows a few of these on their way down to the great sawmills of Rangoon.

A few miles below Tigyaing the river becomes very tortuous, and the channel is split up between many islands and sandbanks, which are constantly shifting their position in such a way that at low water, navigation, even with steamers of very light draught, is rendered extremely difficult. Farther down, on the left bank we pass Tagaung, a village built on or near the site of one of the most ancient cities in Burma. It is, by Burmese historians, stated to have been founded in the sixth century B.C. by Abhi Raja, a Tshatriya prince, who crossed the country from Bengal and named the city he established here

Fig. 3.—In the second defile at the Let-saung-gan Pagoda.

New Hastinapura. Thirty-one kings are said to have reigned at Tagaung up till the beginning of the Christian era, when the monarchy was destroyed by Chinese and Manchu invaders. Many ancient ruins are to be seen here, and terra-cotta tiles with Sanskrit inscriptions are dug up in large numbers. This is a field where the Oriental antiquarian will no doubt one day reap a rich harvest.

Thabeikgyin, the port for the celebrated ruby mines of Burma, is forty-five miles below Tagaung, and near the third or lowest defile of the Irrawaddy. The mines are at Mogôk among the hills, and are reached by a good metalled road through the forest sixty-one miles in length.

The famous Burmese rubies are derived from an alluvial deposit produced by the washing down of decomposed gneiss containing veins of pegmatite (a coarse granitic-looking rock) and beds of white limestone and graphite, apparently of palæozoic age. The minerals washed by the miners from the clay and gravel beds include, besides the prized

Fig. 4.—Lower part of second defile.

Oriental ruby, the following more or less valuable or scientifically interesting gems and crystals:—

Spinel (seven varieties).	Lapis Lazuli.
Sapphire, blue, white, yellow, and green (the Oriental emerald).	Zircon.
Corundum, red and chalcedonic.	Kyalite.
Rock crystal (quartz).	Graphite.
Moonstone.	Iron Pyrites.
	Garnet, red and brown varieties.

Below Thabeikgyin we enter the third or lowest defile, where, for about twelve miles, the river again contracts in width and intersects a low range of jungle-clad hills. The scenery, though very pleasing, has not the grandeur which characterises that of the second defile.

The sketches (Figs. 6 and 7) give a general impression of this part of the river as seen from the deck of the passing steamer. The rocky margins are shaded by large trees, and the smooth face of the quietly

flowing river is enlivened by a constant succession of boats and small craft floating lazily down or sailing slowly up before the gentle breeze.

At the lower end of this defile the river again enters the plain at Kabwet, a village on the right bank, near which is situated one of the coalfields of Upper Burma. This is the only place where coal has been mined in the country as yet, but in the Chindwin district a large coalfield of tertiary age has been discovered, in which it is estimated over 1,000,000 tons can be worked above the level of the river. The tertiary coal of Burma is not equal in quality to the old carboniferous black diamond of Britain, but it is as good as the Gondwana coal of India, which has driven European coal out of the Calcutta market, and it will no doubt prove a valuable national asset one day when the country becomes better opened up for commerce.

Game, both large and small, is, as has been said, abundant in Upper

Fig. 5.—Tigyaing with teak rafts.

Burma, and from the steamer wild boars can be seen crossing the river and otters popping out and in along the banks, but the larger denizens of the forest do not often show themselves close to the river. On Christmas day we drew up at Kyauk Myaung in the Shwebo district, seventy-three miles above Mandalay, and went ashore for some shooting. Our party included some of the ship's officers and a Belgian tourist of a very sportive disposition. Our Gallic companion used to fire his gun at every living object he saw from the steamer, and one day in great excitement he rushed up to me, shouting with wild gesticulations, "Heeppopotamoos! heeppopotamoos! com see heem!" As his hippopotamus neared the shore, however, it rapidly diminished to the size of an ordinary wild pig, and ran off into the jungle out of reach of monsieur's fowling-piece. Our path through the dense bamboo jungle was narrow and tortuous, and led to a lagoon a few miles from the river, which was

reported to be swarming with wild geese, extremely acceptable for a Christmas dinner. The geese were there, sure enough, but proved unexpectedly wild, and as we had neither canoe nor raft at hand to follow them to the distant shore, we never even got within range, and had to be content with snipe and waterfowl, of which we made a fair bag. The jungle round the lake was too dense overhead to give us a chance of hitting any of the large birds that were heard flying from tree to tree, and none of the tigers of the neighbourhood put in an appearance that evening after dark as we threaded our way back to the steamer. It was, however, abundantly clear that game was plentiful, and as the Burmans are not hunters, any one bent on sport should, with proper appliances, have no difficulty in making a capital bag there.

One of the most interesting objects above Mandalay is the ruined

Fig. 6.—A scene on the left bank between the second and third defiles.

pagoda and the great bell of Mingûn. The pagoda stands on the right bank, a short distance back from the river, and about six miles from Mandalay. To reach it, the best way is to take a native boat up from Mandalay, but the passing steamers sometimes stop to let visitors land for a short time. I had an opportunity of visiting it both ways, and would advise any one who wishes to see it properly to take a boat in the morning from Mandalay, and spend the day among the ruins rather than trust to the short interval dependent on the convenience of the steamer.

The bank sweeps up from the wooded shore in a long, gentle slope to the top of the Sagaing hills, 1373 feet above sea-level. (Fig. 8.) The pagoda, a huge red cubical block with several great cracks in its sides visible miles away, rises over the belt of fine old tamarind and mango trees near the foot of the slope, in a conspicuous position overlooking the river. This remarkable edifice was the work of Bodau-pya, who, although a son of Alaung-paya, the founder of the Burmese dynasty, reigned in those troublous days as the sixth king, no less than two

Fig. 7.—View looking down the third defile.

brothers and two nephews having been disposed of before he could reach his father's throne. Bodau-pya reigned from 1781 till 1819, far longer than any of the other sovereigns of his line, the last of whom, King Thibaw, was deposed by the British in 1885, after an inglorious reign of seven years, and is now spending his remaining days with his ambitious wife Supyalat and a few old retainers at Rutnaghiri near Bombay, where he lives in extremely comfortable if somewhat circumscribed circumstances under the benevolent but watchful care of the Indian Government. Both of them, I was informed by a friend who had recently been there, are thriving in their retirement, and look sleek and well-favoured under the excellent means taken during the last fifteen years for their safe preservation.

Bodau-pya wished to immortalise his name, and lay up for himself a

Fig. 8.—Distant view of Mingûn Pagoda.

vast store of merit hereafter, by erecting the greatest Buddhist pagoda in the world, and he spent some twenty years off and on over the first part of his work, which was being executed when Captain Hiram Cox visited the Burmese Court in 1797, and witnessed the gigantic operations.

The Mingûn pagoda is built of well-burnt red brick, and stands in the centre of a broad terraced plinth 450 feet square, rising in five successive steps or tiers, with well-built cornices and projecting mouldings of large bricks. The platform is paved with flat slabs of excellent brick about 9 by 18 inches in size, and the main pile of building rises above it in a square, massive block, with a high, narrow arched doorway in the centre of each face, communicating with chambers inside. The royal architect in his wisdom, instead of arching these apartments, roofed them over with beams of *lead* 5 inches square, and the principal chamber, 15 feet square by 10½ feet high, was lined with sheet lead.

The central block is from its foundation altogether 162 feet high and

230 feet square, and, except for the chambers, is built almost solid throughout. In the huge rents the internal character of the workmanship is laid bare, and it is interesting to observe the excellence of the brickwork from top to bottom. There are here no signs of "dry-packing" or mortar with too much sand, otherwise the building would long ago have crumbled away. Most of the Burmese pagodas are plastered outside and whitewashed, but there is nothing to hide the character of this structure, which, consisting as it does of some 300,000 cubic yards of brick and lime, is probably one of the largest, if not the largest, of solid pieces of brickwork in existence. Towards the top the cubical mass is

FIG. .—Mingûn Pagoda, showing effects of the earthquake of 1839.

surrounded by a plain moulding of projecting courses laid (see Fig. 9) with mathematical precision, above which the beds are drawn in to a flat platform (now broken into large sections) intended to form a foundation for the pyramidal or bell-shaped structure to be erected on it. According to the original plan, the pagoda when completed was to reach a height of some 460 feet, and be nearly 100 feet higher than the famous Shwe Dagon pagoda at Rangoon, the place of greatest sanctity in the whole Buddhist world. This, however, was not to be. Like the still more ancient and more notorious tower "which builders vain presumptuous piled on Shinar's plain" the work of King Bodau-pya was brought to nought ere it was more than one-third up. One account says he was warned that when the building was completed his life would

end also, and another and more probable reason assigned for the cessation of operations was the commonplace one that the king came to the end of his exchequer, after having spent 10,000 viss of silver, or over half a million sterling, notwithstanding that the labour was all forced under the system of corvée then in vogue.

The king, who had gained his throne by the murder of his nephew in 1781, died in 1819, leaving his monument unfinished, and none of his successors ever added to it. The finishing stroke was administered, not by any earthly king, but by the great earthquake in 1839, which shattered it completely, rending it into several pieces, with huge gaping

Fig. 10.—The great bell in the Kremlin at Moscow.

fissures between them, flouting the sky in mute desolation, and now it stands a hideous pile incapable of ever being completed or restored. (Fig. 9.) The earthquake rent it from top to bottom, and the partial collapse of the superstructure was no doubt hastened by the weakly roofed chambers inside, but so good and strong was the lime that the huge masses of brickwork held together like monoliths, displaying an excellence of workmanship that very few British bricklayers ever try to approach nowadays. It is interesting to note that hardly any traces of the rents in the central block are visible in the flat pedestal that surrounds it.

The pagoda was approached by a flight of broad steps and a paved causeway from the river, at each side of which sat a gigantic leogryph or Burmese mythical lion facing the water. These monsters were originally 95 feet high, with white marble eyeballs 4 feet in diameter, but only the

haunches, about 30 feet in height, are now remaining, the earthquake and the storms of a century having demolished all the superstructure.

If the king failed in completing the Mingûn pagoda, he was at least successful in casting the great bell pertaining to it, and in finishing a piece of work which will probably long outlive the best of brick and lime. This bell, which is one of the wonders of Burma, is not so large as the great bell at Moscow, which may be seen standing on a stone pedestal in the Kremlin, at the base of the tower of Ivan the Terrible. The Russian bell, which weighs two hundred tons, is the largest casting of its kind in the world, and, like the Mingûn bell, is made of white or yellow metal, with much silver in it. It is, however, a dumb monument of shattered ambitions, as the triangular piece broken out of one side, as large as the

FIG. 11.—The great bell of Mingûn before 1896.

door of a cottage, renders it quite useless for all ecclesiastical purposes. For the sake of comparison a reproduction of a photograph of this casting, taken during a visit I paid to Moscow in 1897, is given in Fig. 10.

The Mingûn bell, which *can* ring, weighs about eighty tons, or some twenty tons more than the largest of the serviceable Russian bells in the Kremlin, and is thus, for all practical purposes, the largest bell in existence. It was cast on an island on the opposite side of the Irrawaddy, about the year 1797, and was brought over in two large boats, for which canals were cut, to convey it to its destination near the pagoda. The mouths of the canals were closed after the bell was safely across, and the level of the water was gradually raised, so as to lift the boats and their precious burden to the requisite height. Three large teak beams,

supported at the ends on strong pillars, were then slipped through the huge shackle from which the bell was suspended, and when all was ready the water was lowered and the boats removed, leaving it hanging by the neck, and ready to be struck like Absalom in the wood. Natural decay, and the earthquake of 1839, damaged the supports, so that in time they became too weak for the great weight, and the bell sank down, and lay resting on the ground for more than half a century, a mere picturesque curio, with its gigantic shackle and rotting supports overgrown with the shrubs and creepers of the jungle. (Fig. 11.)

After the district became permanently settled down under Her Britannic Majesty's pacific and benign rule, the district magistrate proposed to have the bell raised again, and the Burmans, who, as well as the

Fig. 12.—The great bell of Mingûn after being rehung in 1896.

European residents, were delighted with the idea, came forward with alacrity and subscribed liberally, as is their habit towards all such quasi-religious or holy objects. The bell was accordingly raised, this time with powerful jacks, and hung on a strong steel beam, resting on two massive cast-iron columns, capable of supporting one hundred tons (see Fig. 12). This interesting little bit of engineering was carried out by the Irrawaddy Flotilla Company, which has done so much to open up the country and develop the trade on the river. The operation was successfully accomplished in March 1896, amid prodigious rejoicings all over Burma and the Buddhist world, which went on continuously for six weeks. Pilgrims came from every quarter; it is said some even travelled from places 1000 miles away to attend the celebrations, and the Flotilla Company ran special hourly steamers day and night between Mandalay and Mingûn, to accommodate the crowds of happy visitors.

The bell is of yellowish metal, in which small pieces of gold and lumps of silver as large as a potato are easily distinguished, which have been thrown in without becoming completely fused in the "melt." It is 16 feet high, and 12 feet in diameter at the lip, with a thickness of from 6 to 12 inches of metal. The upper part, as seen from inside, shows some flakes of flat, round-linked chain, evidently put cold into the mould before the molten metal was run in, to strengthen the casting at the place where the strain is greatest. Like other Burmese bells, it has no

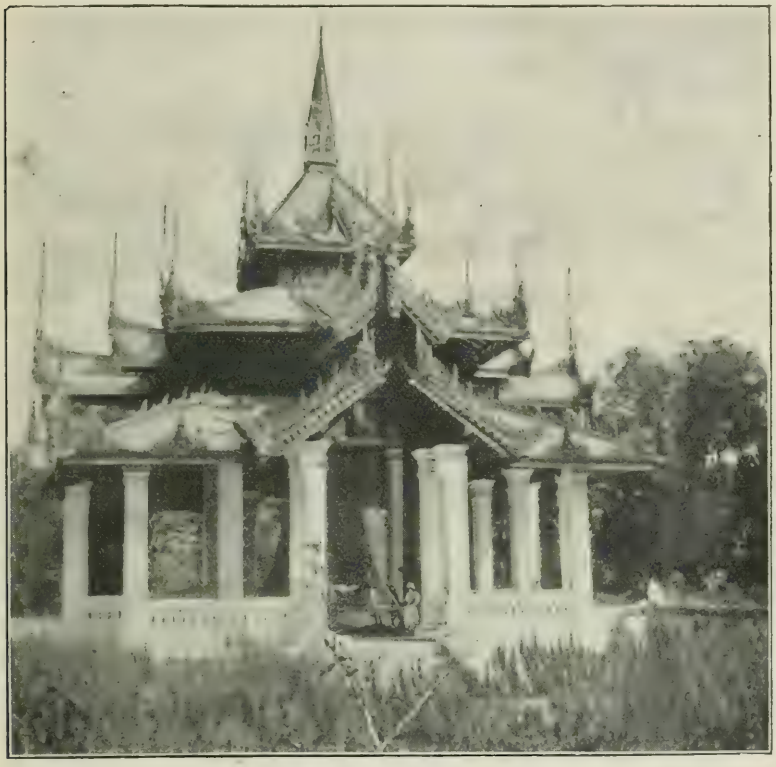


FIG. 13.—The Mingûn bell in 1900.

clapper, and must be struck from the outside with an enormous mallet, or, better still, with a battering-ram, if such were available, to elicit anything like an adequate volume of sound. Nothing but a couple of light spars were to be found near it, but by steadily and rhythmically striking it with these from opposite sides alternately, we were able to produce a considerable volume of deep, rich sound, audible some distance off. The bell has more recently been housed in an ornamental Burmese kyaung, of which Fig. 13, taken from one of my snapshots, gives a representation.

The top of the great pagoda can be reached by climbing up the fissure and broken ruins in one corner. A recent visitor on getting to the

FIG. 14.—View of the Irrawaddy from the top of the Mingún Pagoda.

top had found it occupied by a leopard with a litter of cubs, but no such ill-natured residenter was waiting there to give me a similar warm welcome, and I had time to enjoy the splendid view of the river, and record the outlines of the landscape in my sketchbook. The foregoing illustration (Fig. 14), which will convey a general idea of the fine prospect, shows the river winding across the plain, with the Sagaing hills on the left, and an interesting pagoda in front, with the roof of the kyaung covering the great bell surrounded by trees in the immediate foreground.

Mandalay, the capital of Upper Burma, is quite a modern city, having been founded by King Mindôn, father of Thibaw, who flitted hither in June 1857 with his whole court from Amarapura, the former capital. Amarapura, about eight miles south of Mandalay, was in its turn founded in 1783 by Bodau-pya of Mingûn fame, who changed his headquarters from Ava, the previous and ancient royal city. Ava was founded in 1364, and was not finally deserted by the kings till 1837, when Tharawaddi, father of Mindôn Min, removed to Amarapura. These old cities, now silent and forsaken, are full of the most interesting and beautiful pagodas, temples, and palaces, in all stages of picturesque decay, which I shall not stop to describe, and which must be visited to be appreciated and understood.

Mandalay extends over a broad plain, a splendid view of which is to be had from the top of Mandalay hill, an isolated knoll rising behind Fort Dufferin to a height of some 600 feet above the city. At the base of the hill lies Fort Dufferin, the citadel of King Mindôn Min, with high crenelated walls of red brick, aligned in the form of a square, each side of which is $1\frac{1}{4}$ miles in length. The walls are surrounded by a moat 100 yards wide, full of clear water, and gay with water-lilies, crossed by five bridges leading to the great gates. The carved teak palace buildings in the middle of the great enclosure, where Mindôn lived and ruled, and where his degenerate young son Thibaw, with his dangerous wife Supyalat, played at hide-and-seek, and cruelly did eighty or ninety of their nearest relatives to death, after their old father had passed away, are now no longer the scene of subtle court intrigues and deeds of darkness, but are occupied by benevolent and industrious Government officials, with sober western ideas of a much tamer and more orderly description than those of their more lively, if less logical, predecessors.

Outside the walls the city is laid out in squares, with broad, straight streets on the modern plan. To the left of Fort Dufferin a large white enclosure is conspicuous, with a tall pagoda in the centre surrounded by what from the top of the hill looks like a rectangular encampment of pyramidal tents pitched in concentric lines, with mathematical precision. This is the famous Kûthodaw or Royal Work of Merit erected by King Mindôn in 1859, known also as The 730 Pagodas. Each of the little tentlike buildings surrounding the central pagoda is a small shrine or canopy about twenty feet high, built on four pillars, with arched roof covering a marble slab standing in the centre like a tombstone, and inscribed on both sides with closely and beautifully engraved Burmese

FIG. 15.—The Irrawaddy at Bhamo.

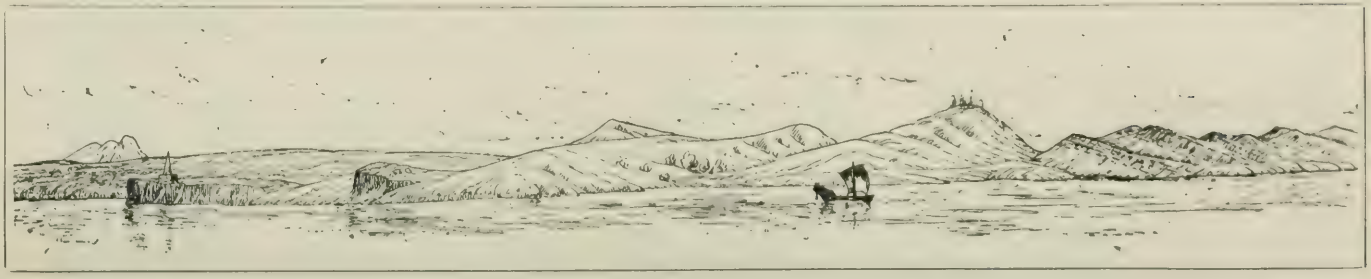


FIG. 16.—Left bank at Singu opposite Yenangyat, showing the crest of Popa in distance on the left.

writing. There are in all 729 (not 450 or 777 as some writers say) of these stone volumes, which record engraven on their faces the whole of the Buddhist law High walls with massive doors surround the sacred enclosure, the work of which is of brick plastered white, the central pagoda being, or having originally been, covered with gold and gems. Although somewhat the worse of the years, it is still a most interesting and fascinating spectacle.

The modern teak palaces and kyaungs, with their painting and gilded ornamentation, are often cheap and tawdry-looking, but there is nothing offensive or exaggerated about these white edifices, which are ornamental without being vulgar, and dignified in their chaste simplicity without being too bald or heavy in construction.

Away over the plain, beyond this biblical enclosure, the vision sweeps over the site of the incomparable (but not incombustible) pagoda, one of the former wonders of Mandalay destroyed by fire some years ago with other sacred wooden buildings or roofs refreshed on [illegible]

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

CHANGE OF ADDRESS.—MAY TERM.

Members are particularly requested to notify changes of address (temporary or permanent), in order to ensure safe delivery of the *Magazine*.

the Irrawaddy valley below Mandalay a few deserve some attention here.

After passing Pako-ku, the great Burmese ship and boat building town of the Irrawaddy, the extinct volcano of Popa heaves in sight, and remains conspicuous nearly as far down as Yenangyaung, rising over the plain on the left bank in an isolated lofty cone, with the broken truncated summit characteristic of a volcanic mountain, about twelve miles distant from the nearest part of the river. (Fig. 16.) Popa has not been active within historic times, and the rim of the crater has suffered much by denudation, being completely cut away at one side by a notch which provides an outlet for the drainage of the basin. The peak consists of ash breccia, and the trachytic lava-flows on the sides descend to the Pliocene gravels of the plain, some of which are interstratified with beds of ash, from which it is apparent that the volcano must have been in activity during the later part of the Pliocene Period. There are now no active volcanoes on the mainland of India or Burma, the mud volcanoes so called being really gas springs or salses, whose action is quite unconnected with

the internal heat of the earth. The only example of an active volcano in the Indian Empire is Barren Island, to the east of the Andaman group, in the Bay of Bengal, and even here the energy is not often exerted, as there has only been one eruption in the nineteenth century. Popa is geographically interesting as being the solitary representative of the northern extension in the Pliocene or late Tertiary Age, of what is known as the Sunda volcanic chain, extending southwards along a definite course through Barren Island to Sumatra and Java, and in these islands including large volcanoes still in a state of great activity.

On the right bank, opposite to and about eight miles below the ancient ruined city of Pagan, the country becomes bare and rugged, and the river follows the base of a range of steep hills for about twenty-five miles. The small oil-field of Yenangyat is situated on the face of the slope, which rises to a plateau, intersected with deep gullies, nearly 1200 feet above sea-level, bare and dry, with nothing but a few bushes or small trees dotted over it. The oil occurs in sandstones of Upper Miocene Age, interstratified with thick beds of clay shale, and the derricks are conspicuous along the face of the hill slope overlooking the river. There are here no less than ten beds of petroliferous sand, one of which reaches a thickness of 133 feet, but is comparatively poor in oil. The production of petroleum has notably risen of late years in the Yenangyat oil-field, and in 1898-99 it was returned at 172,460 barrels, as compared with 83,400 in 1897.

As has been ascertained both in America and at Baku on the Caspian, the oil occurs along arches or lines of anticlinal bending in the strata. In this district two well-marked anticlinal axes have been traced running north and southwards along the Irrawaddy valley. The eastern anticline includes the oil-fields of Yenangyat and Yenangyaung, and the western the unproductive oil-field and the mud volcanoes of Minbu.

Most of the oil is obtained from the Yenangyaung field, and from a very restricted area there, not more than 350 acres in extent. The country forms part of a low plateau, about 480 feet above the high-water level of the river, and 750 feet above the sea. It slowly rises as it recedes from the river, and is intersected by numerous ravines, generally dry, but liable to become suddenly occupied with deep torrents during the rainy season. The oil-tract, which is a couple of miles from the town of Yenangyaung, has a length of about two miles, and an average breadth of barely a quarter of a mile. Something like 600 wells have been sunk by the natives, or drilled on the modern American system within this area. The Burmese oil-fields have no fountains, such as are common at Baku and in America; and although at first a few of the wells have been known to flow, the oil has always to be pumped, or, if worked on the old native system, to be drawn up in earthenware jars. The whole production is, no doubt, comparatively small, but a small industry may yield as good interest as a large one, and the Burmese oil industry, which has been in existence for at least 150 years, is still being carried on with remunerative results. The production has increased greatly since 1886, previous to which year it probably never exceeded 45,000 barrels annually. In 1888 it was 62,721 barrels, and in 1893, five years

later, it had risen to 240,141, while for the year 1898-99 the total production of the Yenangyaung, Yenangyat, and a few other insignificant oil-fields was returned in the Government Report at nearly 602,000 barrels of 35 gallons capacity.

The western or Minbu anticline, to which allusion has already been made, although marking a line of oil-bearing beds, has now been abandoned as an oil-field on account of the poor returns obtained after extensive trials by boring. It is, however, interesting for the group of curious mud volcanoes that have been thrown up near Minbu, a civil station on the right bank, twenty-five miles below Yenangyaung, and 112 miles above Prome. Minbu is not very accessible to casual visitors, and is not a particularly desirable place for European residence. It is known as one of the hottest places in the Indian Empire, the temperature in April and May being often as high as 107° F. in the shade. As we were passing so near this curious spot I was anxious to see the volcanoes and compare them with others I have had an opportunity of examining at Rotorua in New Zealand, in the Yellowstone Park in America, and at Kerch on the Crimean coast of the Black Sea. It was late in the afternoon when our steamer drew up for the night at the wharf about three miles below the township, but with the assistance of the obliging agent of the Irrawaddy Flotilla Company, who acted as our guide, we obtained a bullock gharry, and were slowly trundled on the jolting, creaking vehicle along some four miles of a dusty road to the uncanny spot. Save for the honour and glory of the thing, we could have made the journey much better and quicker on foot.

As evening drew on, while passing a patch of jungle, our attention was drawn to a couple of Burmans hurrying stealthily along through the bushes. One carried a square box of sheet-iron, like a domestic coal-scuttle turned upside down and minus the door. The other had a long bamboo rod in one hand and a rattle in the other, made of a ring of wire, on which were strung some discs of brass, which he kept constantly shaking as he trotted noiselessly along. These were Burmese rabbit-catchers, our guide explained, and their method of business is a simple one. It struck me that the rabbits must be greater simpletons still, but Burmese rabbits' ways of thought may be as difficult for Europeans to understand as are the minds of the human inhabitants of Burma and India generally. The rattle is kept going to prevent the rabbits from hearing the *noise* of the hunters' footsteps, as they stalk cautiously along with their bare feet. The scuttle is then laid down at a likely place, and a piece of cotton soaked in kerosene is lit inside it so as to shed a ray of brightness, as from a lantern or searchlight, into the bushes in front. The rabbits, moving about in the gloaming, being attracted like moths to the light, come out of the bushes and play among the grass, or on open ground in the brilliant rays, gradually moving nearer and nearer to the lantern, behind which, in the deep shade, sit the stealthy hunters. When within range, down like a shot comes the long bamboo on the simple little victim, whose carcase is promptly popped into the game-bag as the sportsmen trot off to repeat their attractive and striking operation at another part of the jungle.

FIG. 17.—The mud volcanoes of Minbu.

The mud volcanoes were extremely interesting, and much finer than any I had seen in other countries. These have one distinctive feature which was new to me. Other mud volcanoes (so-called) are generally produced by gas of a non-inflammable character, such as carbonic acid or steam with sulphurous fumes—the expiring breath of former volcanic energy in the neighbourhood. At Minbu, on the other hand, there are no traces whatever of volcanic action, the rocks being entirely sedimentary for thousands of feet in depth, and, with the exception of Popa, which is over thirty miles away, and has been extinct for ages, entirely beyond the zone of subterranean fire. The Minbu salses, for such they are in reality, are due to the escape of carburetted hydrogen from the oil-bearing strata on the top of the anticline, which rises through the clay-beds, mixed with a little water and oil, and slowly bubbles up at certain spots. As the gas and water rises, it brings up a little grey mud, which, on exposure to the air, dries and hardens, while the water evaporates, producing first a low crater basin with a dry rim of mud, then a cone with a crater on the top, in the centre of which the gas finds vent. The cone continues to grow as long as the necessary small quantity of mud and water is brought up with the gas. As each bubble of gas bursts, it gives a kick to the mud in the crater, sending a wave circling outwards to the lip, and splashing some of the sluggish fluid over the lowest point, to flow down the steep side by gradual degrees, exactly imitating, on a miniature scale, the narrow valley glacier with crevasses on the surface, or the form of a real stream of viscid lava.

There are at Minbu three groups of these vents—the northern, the middle, and the southern ; but the two first-named groups are only mud-holes, covered with a brown film of petroleum, through which the gas is constantly bubbling. The conditions have not been present here for the building of regular steep-sided cones. The southern group contains all that is most interesting, and the vents are here surrounded by excellent cones, some of which are 20 to 40 feet in height, and are in a state of constant activity. Of the three largest, one was extinct, or practically so, at the time of my visit, one in a state of modified activity, and one (shown on the left side of the photograph of the group, Fig. 17) very active indeed. The steep upper part of this "volcano" rises about 15 feet from the flat cone on which it stands, and on climbing to the top, the summit is found to be occupied by a crater about 6 feet in diameter, full of viscid, grey mud rising to within 3 inches of the lip. Every four or five seconds a subterranean gurgling or rumbling is heard in the throat of the "volcano," immediately followed by the swelling up of the thick liquid in a great bubble, which rises to a height of a foot or so and then bursts, flinging back a wave of mud all round, and scattering some splashes over the edge as it suddenly collapses. The gas, as I have said, is inflammable, unlike that of most mud volcanoes ; and to test its combustibility, we had provided ourselves with long bamboo rods, with a tuft of cotton-waste soaked in kerosene attached to the end. This we lit and cautiously held over the bursting bubble, when suddenly a brilliant sheet of flame, blue at the base and bright yellow above, shot upwards for 10 or 12 feet, illuminating for a few seconds the whole landscape for at

least a mile around. It was so dark before we returned to our ship that we could neither take sketches nor photographs, but we had some compensation in thus witnessing the full effect of the illumination by the natural gas, which in brilliant sunlight would have been quite lost. Other vents burned spasmodically, but none with anything like the intensity or frequency of the large one. The river was low at the time; and it has been observed, that when the rains set in and cause the water to rise 20 or 30 feet, the activity of the volcanoes increases, no doubt because of the increase in hydrostatic pressure on the gas-bearing beds in the vicinity.[1]

The mud volcanoes of Kertch on the Black Sea are much smaller

Fig. 18.—Mud volcanoes at Kertch on the Black Sea.

than those of Minbu, as will be seen by the above photograph of the largest of them (Fig. 18), taken during a visit made by the writer to that region some years ago.

In a country like Burma, where the belief in evil spirits is prevalent, it is not surprising that the natives hold this eerie spot to be the haunt of *nats* or demons. Near the principal vent, a small pungikyaung or monastery, consisting of a platform on four posts supporting a thatched roof about 6 feet square, has been erected, where a pungi or monk can

[1] For a full description of the Yenangyaung and Yenangyat oil-fields and the Minbu volcanoes, see Mr. Noetling's account in the *Memoirs of the Geological Survey of India*, vol. xxvii. part 2. 1897.

reside, and make propitiatory offerings to the *nat* of the volcano. This is, however, quite an innocent place in comparison with the neighbourhood of Tikiteri, near Lake Rotorua in New Zealand, where the ground bubbles and splutters with boiling mud, and the air is redolent of fire and brimstone, while the smoke of the bottomless pit, ascending through sulphurous cracks and crannies, hangs in clouds over a crust so dangerously thin, that a single false step might at any moment pierce it and precipitate the unwary into the immediately subjacent infernal regions. It does not require a poet's phantasy in such a place to picture the Prince of Darkness himself popping up from one of these mud volcanoes, or from the dismal recesses of one of the gruesome mud caldrons that boil and bubble around them.

The mud volcanoes of Minbu, although extremely interesting in their way, are greatly inferior in point of size and activity to those of Ramri and Cheduba Island on the Arakan coast of Burma, which are in a remote locality, seldom visited by travellers. These are similar in origin to the Minbu vents, but rise to heights reaching 300 feet, and are subject to paroxysmal eruptions of great violence, in the course of which stones of a considerable size are thrown up. Gas is emitted in immense volumes, and curiously enough this is known to take fire spontaneously, causing these orifices to still further simulate true volcanoes, with which they have in reality no physical connection whatever.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in April.

Major E. J. Medley, 17th Bengal Lancers, addressed the Society as follows, on his journey from India to England by way of Central Asia and Siberia:—In Edinburgh on the 4th, General Chapman, C.B., in the Chair; in Dundee on the 5th, when Mr. I. J. Weinberg, J.P., presided; in Glasgow on the 11th, when Mr. R. S. Allan was the Chairman.

Meeting of Council.

At a Meeting of Council held on the 18th the following new Members were elected, viz.:—

Carlo Iberti, Ph.D., D.Litt.
C. M. Pelham Burn.
R. R. V. Jeffreys.

At the same meeting the following gentlemen were appointed Corresponding Members, viz.:—

Dr. Otto Nordenskjöld, *Leader of the Swedish Antarctic Expedition.*
Major E. J. Medley, *India.*

The following letter, addressed to the President of the Society by the Secretary for Scotland, was read:—

SCOTTISH OFFICE,
WHITEHALL, *30th March* 1901.

SIR,—I am commanded by the King to convey to the Royal Scottish Geographical Society His Majesty's thanks for the expressions of sympathy with His Majesty and the Royal Family on the occasion of the lamented death of Her late Majesty Queen Victoria, and also for the loyal and dutiful assurances on the occasion of His Majesty's accession to the Throne contained in their address which I have had the honour to lay before His Majesty.—I am, your obedient Servant,

BALFOUR OF BURLEIGH.

MEETING ARRANGED FOR MAY.

Captain H. H. P. Deasy, late 16th Lancers, will deliver a lecture in Edinburgh on the 9th May on his Central Asian travels, entitled, "The Roof of the World."

GEOGRAPHICAL NOTES.

Royal Meteorological Society. — At the March meeting of this Society Dr H. R. Mill lectured on "Climate and the Effects of Climate," pointing out many interesting examples of the influence of climate—which might roughly be called the average weather of a place—upon vegetation, architecture, and industry. A short account of the lecture, illustrated by photographs, is given in *Symons's Meteorological Magazine* for April.

Mining in Thessaly.—H.M. Consul at Volo, in his report to the Foreign Office, states that the area of declared mining land in Thessaly amounts to 250,260 acres. The district of Magnesia heads the list with 144,742 acres, followed by Larissa with 66,698 acres. No working concessions have been anywhere recorded, and hitherto no success has attended the efforts to work the mineral resources, which consist of lead, iron, copper, and other ores. Although it is affirmed that the natural obstacles are such as to defeat any attempts to establish the mining industries on a paying basis, there is little doubt that the districts specified contain many valuable ores in quantities so considerable as to offer a growing field for future enterprise.

The late Professor Paul Chaix, of Geneva, died on March 28 in his 93rd year. This distinguished geographer, born at Crest on October 1, 1808, was the son of Georges Chaix, a painter, of French and Spanish origin. At the age of seventeen he became a tutor, and from 1829 to 1832 was employed in this capacity by the Duke of Richmond, publishing at the same time his *Carte de Savoie*. After two years at St. Petersburg, and a year of study at Paris, he was appointed teacher of geography and history at the *Collége industriel* of Geneva, where he published his *Précis de Géographie élémentaire* and his *Atlas de Géographie*, and was intrusted with the education of several foreign princes during their residence in that city. Deprived of his chief occupations by the revolution in Geneva in 1846, M. Chaix travelled in Egypt for a year. His *Histoire de l'Amérique méridionale* appeared in 1853, when he received the Order of Charles III. of Spain. Appointed professor at the *Gymnase* in 1868, and professor at the University in 1872, M. Chaix became known as a teacher in geography of very unusual

power and influence, and until 1882, when he retired from active university life, he was the means of educating many original workers in the same study. Besides the works already mentioned, Professor Chaix was the author of *Lettres des bords du Nil* (Bibliothèque universelle, 1847), *Hydrographie de l'Arve*, and of many papers scattered through geographical reviews, especially those of the Geographical Society of London and of the Scottish Geographical Society, and in the *Bibliothique universelle*, *le Globe* (of the Geographical Society of Geneva), and the *Archives des Sciences physiques et naturelles*. M. Chaix was a corresponding member of many geographical societies, of which the Scottish Society is not the least indebted to his learning and his courtesy.

ASIA.

The Phosphates of Christmas Island.—A report from H.M. Consul at Yokohama regarding the Phosphates of Christmas Island, more especially in reference to their export to Japan, has been received at the Foreign Office. An attempt made last year to introduce into Japan artificial manure in the form of fossilised bird-deposit, or phosphate of lime, appears to have met with considerable success. Christmas Island, the concessionaries of which are the Christmas Island Phosphate Company, Limited, of Billiter Buildings, London, was taken possession of in the name of the British Government in the year 1888, and is administered by the Government of the Straits Settlements. It is twelve miles long from east to west, and ten miles wide from north to south. The bird-deposit found on its surface is said to contain 86 per cent. of phosphate of lime, in lumps weighing from 1 to 30 lbs. Besides this deposit found on the surface, which is said to be covered to a thickness of about twelve inches, and which is at present alone worked, one other seam at least is known to exist, from five to six feet under the surface, of a thickness ranging from two to three feet, and containing about 96 per cent. of phosphate of lime.

The island contains no indigenous inhabitants. The present population are all engaged in the phosphate industry, and consists of eight Europeans (British), seven hundred Chinese coolies, with fourteen Sikh policemen to preserve order.

The phosphate is placed by the coolies in small iron trollies, which are lowered down the face of the hill on light iron rails, to within about 2000 yards of the tipping shoots, by means of a wire rope, attached to a large drum, the laden trollies hauling the empty ones to the top of the island. After being tipped from the trollies, the phosphate is loaded into trucks, from which it is tipped into lighters, which are hauled to and from the vessel by means of a warp. The discharging of the contents of the lighters is a very tedious process, nearly all the phosphate having to be placed in iron tubs by hand. A pier for the vessel to lie alongside, from which the contents of the trucks could be tipped direct into the hold of the vessel, would be an enormous saving of time and labour. At present it requires six days to load ; under altered conditions a few hours would suffice.

In Japan, the method of preparing the phosphate for use as a fertiliser, is to open up the phosphate rock with sulphuric acid. It is then called superphosphate, a substance which has not been in use long enough to form an exact idea as to its specific value as a manure.

The Etrofu Sulphur Deposits.—Etrofu, the recently opened source of sulphur supply, is a little island situated about half way between the extreme northern point of Japan and the southern point of Kamchatka. It is volcanic, with three cones, largely composed of sulphur, rising to about 2800 feet in height. It is owned by a Japanese syndicate, which holds a grant from the Japanese Government. From the sulphur deposits, which lie about two miles from the coast, 10,000 tons

of sulphur were mined and transported to the sea-level between 15th May and 10th October 1900. Of this, 6000 tons were shipped to Hakodate, Japan, where a refinery has been established, the remaining 4000 tons being refined on the ground at Moyoro Bay. During the latter part of the season, the rope-transmission plant brought the sulphur down at the rate of about 3000 tons a month.

M. A. Leclère's Observations in Southern China, which are the subject of an article by M. Paul Barré in the *Revue française de l'Etranger et des Colonies* (April 1901), were made when M. Leclère, a mining engineer, was attached in 1897 to the expedition of M. Guillemoto, who was engaged in prospecting with a view to the construction of railways. In eighteen months the expedition travelled over 3726 miles. M. Leclère joined M. Guillemoto at Hanoi in January 1898, went up the Red River as far as Lao-Kai in a junk, and then on to Mong-Tse. He remained for three months in this region, exploring the route of the future Yunnan-Sen railway; then proceeded to Yunnan-Sen and Tali-fu, then back to Yunnan-Sen and as far as Kwei-Yang-Sen, with M. Monod. Finally, M. Leclère passed from the province of Kwei-Chau into the province of Kwang-Si, and travelled from Kwei-Lin-Sen to Hanoï by Liu-Chau, Nan-Ning, and Langson. Some of his observations were as follows:—

Orography.—Southern China is uniform except for the coast range of Fu-Kien; it is bounded on the north by the Tsin-Ling range, and on the south-west by continuations of the Himalayas.

In the higher regions and in districts inhabited by aborigines thick forests are found. On the other hand, forests, and even single trees, disappear before Chinese civilisation. The Chinese destroy the trees, and the yearly burning of the dry grass prevents re-foresting.

Everywhere, even at an altitude of 8400 feet, one sees the same sharp, fantastic formation as characterises the Bay of Along and the Langson railway. It is like the Tyrolese Dolomites. The landscapes so well known in Chinese works of art are strictly true to nature. Between the great ranges the old lacustrine basins are often transformed into rice-fields, and sometimes stretch more than 60 miles from north to south. The altitude of these plains, which is 1200 feet in Kwang-Si, rises to 3000 feet in the eastern district of Kwei-Chau, and reaches 4500 feet in Yunnan in the Mong-Tse region, 6000 feet at Yunnan-Sen, and 6600 feet at Tali.

Communications are very insufficient. There are no roads, but only paths; and in some districts these are not passable even for pack-horses. Over many rivers there are no bridges, and they can only be crossed by boat. Where there are bridges they are reached by steep steps from the path. The roads near the villages are so coarsely paved that walking on them is painful, while those roads further out are constantly being changed to avoid bad places. To escape the exactions of the mandarins the villages are often situated far from the roads; in districts apparently quite barren one frequently discovers little settlements in the hollows among the rocks. When the soil is not fertile famine is not uncommon, for the natives cannot pay for imported food; the cost of carriage is about 5d. a ton for three-quarters of a mile, and the average wage of a labourer on the Chinese plains is only 2½d. to 3d. a day, and still less in the native districts.

Population.—The population of Yunnan is estimated at twelve millions, that of Kwei-Chau at eight millions, and that of Kwang-Si at five millions.

The population of Yunnan and of Kwei-Chau has considerably diminished since the rebellion, which came to an end in 1870. For instance, Tali-Fu, which had 35,000 inhabitants, has not more than 6000 or 7000. Thus in many places, as

that near Mong-Tse, one discovers deserted rice-fields. Plague also has made great ravages, while famine, caused by insufficient rain, has driven whole villages to emigrate. In spite of the prolific character of the yellow race, these provinces are being very slowly repeopled. It takes several generations to build up the terraces of the hill-sides for growing rice. The disappearance of the forests has deprived the agriculturist of fuel and building material. At Kwang-Si, a desolated country, they have had to reserve land for growing grass to burn. The population, although slowly growing in Yunnan and Kwei-Chau, is still decreasing in Kwang-Si, owing to the brigandage still active there.

All these causes explain why the Chinese provinces near Tonkin are ranked among the poorest of the empire; but the railway will give a great start to their development. They contain a great many aborigines living in more or less isolated groups, whose independence the Chinese have in vain tried to break. Each tribe has its own dialect and customs, and considers itself a distinct race. From Laos to Ta-Li and Tibet the western district of Yunnan and of upper Tonkin contains an ancient aboriginal race, possibly of the Malay stock. The people known as Sen-Miao-Tse in the west of Kwei-Chau are aborigines; but lost their independence in the last rebellion, and now own the authority of the "tao-taï" of Kao-Chau.

The Miao-Tse, who have much in common with the Méos of upper Tonkin, are very far from being savages. Their are clever at making stuffs, trinkets, and guns with very curious locks, while their well-paved roads recall the ancient chaussées of the Rhone.

In the middle part of Kwei-Chau, to the south of Yunnan and Kwang-Si, are the Tong-Kia, the Chong-Kia-Tse, and the Long-Yen, who constitute the products of Chinese immigration, but the majority of the people in Yunnan are Manns, Lolos, and Lissus, descendants of the Mongols.

The Lolos have escaped Buddhism, which penetrated to the far north of China, and have remained fetish-worshippers. Their dwellings are small cabins, often made of trunks of trees, placed horizontally and fastened at the corners like Russian "isbas." While the Chinese only raise pigs, the Lolos have flocks or horned cattle, and use milk. They rarely mix with the Chinese; their customs are quite different; girls go about freely before marriage and meet young men at their singing-parties; young married women go home to their parents for some time three days after their marriage; the eldest son, following an old Mongol custom, is not considered the head of the family, the inheritance often descending to younger sons.

The Lolos are hospitable, fear the Chinese, and are exclusively agriculturists. The women weave various stuffs of wool, goat hair, etc.; many of them are quite of the European type, as was noted of the Lissus by Prince H. d'Orleans. Their dress varies according to their tribe. The girls roll their hair on the top round a wooden ring. In Léan-Tchang the women wear a square head-dress, a black bodice embroidered in red, and a long petticoat which they hold up when they walk. The men wear embroidered vests, and are almost all agriculturists, although one comes across a few as miners in Yunnan.

Muslims are numerous in Yunnan (about a million); of Turkish descent, they have a great contempt for all other races. Their Islamism consists mainly in a horror of pork. They do not attempt too much work, are active, energetic, violent, and difficult to get on with. The last rebellion was only suppressed with the help of a party of Muslims engaged by Chinese mandarins. These Muslims always furnish soldiers and military mandarins to the provincial army.

The Chinese officials intrusted with the rule of so many different races in

Yunnan are effective because of their intellectual superiority. The mandarins are feared, but respected, and, thanks to their summary methods, peace is kept between the various rival races. In the villages local government results from the absence of means of communication.

Climate.—The climate is very variable owing to the different altitudes of the provinces near Tonkin. In winter the coast districts and the central basin of Kwang-Si are refreshed by the monsoon from the north-east, which for some time gives the Tonkin delta a temperate climate. Higher regions are under a special *régime*. The name of Yunnan means "region south of clouds." In the higher altitude where clouds are rare, the sun shines brightly while it is veiled to places lower down. A dry wind keeps the temperature moderate (+25° in the middle of the day, dropping to +15° or +10° during the night). At 6600 feet, that is to say, at the altitude of Tali-Fu, snow occasionally falls. The dry season in Yunnan lasts from the 15th September till the end of May; it is characterised by falls of yellow sand, carried by the wind. The severest winter occurs in the lower parts of western Kwei-Chau, where the monsoon from the north-east, alternating with the south-west wind, produces sudden changes, at Kwei-Yang the temperature sometimes falling to −9°.

The wet season begins about the 25th of May. Its reign, which commences with great storms, moves slowly inland; in about a month it is established at Yunnan-Sen, and later still rains over Tali. Land communication is often interrupted, and the rivers serve for transport, the junks then being able to navigate a considerable distance up stream. At Lang-Chau the unimportant stream which comes from Tonkin rises 70 feet, while on the Blue River there are traces of a rise of 120 feet. Malarial fever is not troublesome in the cultivated plains, but is active in shut-in places even at a high altitude. Typhoid is common because of the ignorance of hygiene among the natives. The other most common diseases are smallpox, plague, leprosy, and ophthalmia. Old age comes on at forty, and the natives rarely live past sixty. Still Yunnan is less unhealthy than Tonkin; missionaries have lived there till they were venerable. Kwei-Chau is more damp but relatively healthier. Kwang-Si is as unhealthy as the worst districts of Tonkin, and Europeans cannot live there for any time. The inhabitants of the upper parts die off as soon as they descend to the lower regions.

Agriculture—Rice, the foundation of Chinese life, grows well up to 7500 feet, and gives a 250-fold return in the fertile plain of Tali-Fu. It is cultivated in every corner where there is moisture.

European plants grow well during winter. In well-watered places maize is grown instead of rice, and does splendidly. After the summer and autumn harvest a second spring harvest of wheat, barley, hay, and above all opium, which makes a very good return, is usually obtained. Potatoes are being introduced; the vine grows wild; grapes are on sale at Yunnan by the end of May, and the difficulties of wine-making have been conquered by the missionaries. Apples and pears do well. Cherries and peaches are common around Mong-Tse. Tobacco is grown everywhere.

The aborigines have herds of cattle; sheep do not do well above 6600 feet. They are very common on the upper region of the Blue River, and a fine specimen can be bought for eighteenpence. Agriculture, however, cannot develop in Yunnan till better communication with Tonkin is established.

Commerce.—Trade is entirely local, owing to the few roads. Industry is in the same position as trade. The most important manufactory is a textile factory a Tali, which employs thirty hands.

The Chinese provinces near Tonkin have everything that is needed for pro-

sperity except outlet, and it is expected that great changes will follow the opening of the railway.

AFRICA.

Major A. St. Hill Gibbons's Explorations in Marotseland, which were the subject of his recent lecture to the Royal Scottish Geographical Society, are recorded by him in a contribution to the *Geographical Journal* (February 1901). The objects of the expedition, which was undertaken in July 1898, were—to map the country; to study its commercial resources; to investigate the practical use of the Zambezi and its tributaries as waterways; and, especially, to determine the limits and tribal distribution of the empire of Lewanika, chief of many tribes in the upper Zambezi, and ruling over a country extending from the Congo-Zambezi watershed in the north to 18 S. lat. in the south, and from Kwito in the west to the Kafukwe in the east. The importance of the investigation of this boundary is due to the Convention with Portugal of 1891, under which the Anglo-Portuguese boundary is identified with Lewanika's western frontier, which has hitherto been so indefinite that the limit has been variously located between the Zambezi and from 200 to 300 miles to the west of that river.

Major Gibbons has preferred, in this expedition as in his explorations of 1895 and 1896, genuine geographical research to sensational records. 'I have always felt,' he says, 'that long, straight routes through Africa ceased to be of anything more than very ordinary value when once the main features of the continent had been determined; and that to turn a somewhat hard and uncertain profession to its best account, the latter-day explorer had best select a circumscribed district and work it thoroughly; 5000 miles within such an area is immeasurably more valuable than the most imposing line from coast to coast. If, therefore, the expedition deserves any credit for its work in Africa, we claim it not for the lines we have made from Capetown to Cairo and from Chinde to Benguella, but for the more serious and useful work we have accomplished in Marotseland.'

Avoiding the great expense and inconvenience of land transport by native carriers, Major Gibbons and his companions, Captain Quicke, Captain Stevenson-Hamilton, Mr. L. C. Weller, Captain Boyd Alexander, and Mr. Ramm, started from the Chinde estuary of the Zambezi with two aluminium launches, 26 feet by 6 feet 6 ins., and a barge 22 feet 3 ins. by 6 feet 6 ins., on board the *Centipede*, to the foot of the Kebrabasa Rapids. The launches were built in sections, so that they could be lengthened or repaired by introducing a similar section from the barge. Mr. Theo. Müller travelled overland from the Cape to join the expedition at Tete.

Although the steamer drew no more than 28 inches, the Zambezi was so low that three weeks, instead of one, had passed, before Tete was reached. Except at one place, where the river is constricted into a rapid current at the Lupata gorge, it was a mere sandbank, from three to five miles wide, threaded here and there by shallow streams. After infinite labour, in towing and even digging, the *Centipede* was brought to the rocky gorge of Kebrabasa, where the rapids form an insuperable barrier to navigation. Here nearly six weeks were spent in the portage of 70 miles, for which over 450 porters had to be engaged; and the expedition was not encamped at Chiloa until September 21, two months and five days from the start.

After steaming for some days in the launches, it was found that the latter were so overloaded that very little progress was made: the expedition therefore divided, Major Gibbons, Mr. Weller, and Captains Quicke and Hamilton going on in a light steamer, while the rest of the party followed with the bulk of the supplies. This reach of the river, below Zumbo, is for the most part shoal water, but sometimes becomes a deep stream, and at two places, Chansenga and Kakolore, there are

rapids. On October 22, the day after Zumbo was passed, the expedition reached British territory; the country became hilly, and the banks were well wooded. On the 24th the Kariva or Lupata gorge, "one of the grandest pieces of scenery on the most beautiful of the four great rivers of Africa" was entered.

The rapids near the eastern entrance of the gorge, and the difficulties of their passage, are graphically described by Major Gibbons:—"With a fall of 3 feet in 30, the river rushes between rocky banks only 40 yards apart and then flows in a seething current for some 250 yards. With the help of a backwater we reached a small bay immediately below the rapids. In the first attempt—using of course the tow-rope—the bows of the boat got wedged between two hidden rocks. Lowering her down, the goods were off-loaded, and we tried again. This time the rope was forced from the boys' hands, and we were swished down stream for some 200 yards before we could get into quieter water. Next time the rope, refusing the strain, broke, and away we went once more. The fourth attempt proved successful after a long, hard pull. So great was the rush of water at the critical moment, that, while the bows were all but submerged, the keel immediately beyond was almost laid bare. Four years earlier a Portuguese officer lost his life in these rapids. While being towed through, the rope broke, the boat capsized in the rushing water below, and he, with part of his crew, was drowned. Once in the gorge, we steamed through a deep, slack stream confined within narrow limits by precipitous wooded mountains. As the river widened things changed for the worse. Three days of much tow-rope and little progress culminated in an accident, which promised at one time to be serious. Thrice the rope was forced out of the boys' hands in attempting to pass a rapid, and the last time became entangled in the screw. We had sprung a serious leak after a succession of violent bumps on the rocky bed, and with our screw helpless bade fair to go down in deep water. The rope was disentangled none too soon, and we made a stony island in a sinking condition."

From the confluence of the Kafukwe to that of the Sanyate the navigation was easy; but the rapids in the Kariba gorge were so dangerous that the boats and stores were carried overland for three miles. For the next hundred miles the travelling was easy; the deep river flowed between high banks, and the surrounding country was more thickly populated than any other part of the middle river. The last 25 miles of the river journey were the hardest; after a succession of about twenty rapids, many of them within a deep, narrow gorge of basaltic rocks, Major Gibbons left the steamer, and in twelve days reached Sesheke. Thence, crossing the Zambezi, he crossed the flat, almost waterless, country lying between the Kwando or Linyante and the parent river, reaching Mamili four days later. After passing the Kwando in 18° 7′ 30″ S., a southerly course was followed until the dry bed of the Mag'wekwana, which connects the Okavango with the Kwando after rains, was struck; on April 14 the overflow from the Okavango began, and the whole country was inundated, so that the expedition had to wade knee-deep for nearly four days. Two distinct tribes inhabit this district: the Maiye, who resemble the South African natives in type, but are a shade lighter in colour and wear their hair short; and the Mampukushu, who are quite black, and live in conical grass-thatched huts. The light-coloured bushmen, of very primitive habits, were met with up to the confluence of the Kwito, which Major Gibbons traced for over 100 miles.

Arriving at the Kwando-Kubangui confluence on June 2nd, the expedition rested for a week. Here the chiefs and porters became mutinous, so that the leader was forced to abandon his intention of travelling due north to the Congo-Zambezi watershed, and had to march them for 300 miles to Lialui. Here Captain

Quicke rejoined Major Gibbons, and on September 3rd they both set out for the north; the former for the west coast *viâ* the Kafukwe, and Major Gibbons for the source of the Zambezi, to follow the Congo-Zambezi watershed eastwards, and to strike northwards for the Nile.

The Mary Kingsley Society of West Africa has been established in memory of the late Miss Kingsley, whose acute and sympathetic researches into native customs and institutions, and into the native mind, have been invaluable not only for their intrinsic anthropological interest, but also, and perhaps to a greater degree, for the method which they illustrate for the solution of certain Colonial and Imperial problems. "Miss Kingsley held," says the circular which has been issued in support of the 'National Memorial,' "that the right way to bring out the full value of British West Africa is, not in the direction of trying to force European civilisation and customs on natives who already have a different, if rudimentary, social system of their own, but first to study this indigenous system, which must to some extent be suited to its environment, and then to select from this, and to develop, the better and more useful elements. It is believed that much information of the required kind as to West African sociology is already on record, scattered through the works of the older writers on those parts as well as in more recent books of travel, in papers published in periodicals, in blue-books and in official reports; and a very great deal more may still be gathered by Government officials, traders, missionaries, travellers, and by the small but remarkable band of natives who are already educated. It is proposed that the 'Mary Kingsley Society' should employ a trained ethnologist, both to collect and arrange in scientific form the material which is thus already on record, and to institute and direct research for further material of the same sort; and it is intended that the Society, after the manner of the Royal Asiatic Society, should periodically publish the results which it obtains, and should thus provide additional knowledge by which European relations with West Africa may be most safely and effectively directed, with profit both to the natives and to the Empire." An able and influential executive committee has been formed, of which Mrs. Stopford Green is secretary, and Mr. George Macmillan, of St. Martin Street, Leicester Square, London, is treasurer.

AMERICA.

A scientific expedition to the interior of Dutch Guiana, which is being organised by the Royal Netherlands Geographical Society in combination with two Dutch colonial societies, is to explore the basin of the Kopename, in Central Surinam, starting from the Raleigh falls and proceeding up the river to the mountains. The expedition will be directed by L. A. Bakhuis, who was associated with the Ijzerman expedition of 1890 to Sumatra, and will be accompanied by W. L. Loth, who has considerable experience of surveying in Surinam.

Dr. Carl Sapper's researches into the structure of Central America, which have been published in the *Verhandlungen* of the Berlin Geographical Society (1900, viii.), are summarised in the *Geographical Journal* (April 1901). Dr. Sapper, whose paper is illustrated by a diagrammatic map, points out that the characteristic form of most of the mountain ranges of that country, especially in its northern half, is a regular curve, generally concave to the north. The only regular curve in the south is the central chain of Costa Rica, which is not certainly known to be of the same age as the older part of the northern chains. The latter are largely composed of archæan rocks; certain chains are wholly formed of gneiss, mica-schist, and phyllite. These primitive ranges, which are

continued on the one hand in South-West Mexico, and on the other hand in the Greater Antilles, were exposed during the first half of the Palæozoic period, but were at least partly submerged by the sea in the Carboniferous period; at the close of the latter epoch there was a new period of folding, during which most of the old eruptive rocks were extruded. "After this, most of the country was above water till towards the close of the Mesozoic epoch, only to be submerged again, with the exception of the Palæozoic chains, during the Cretaceous and Early Tertiary. The Mesozoic folded ranges are best developed in the west, in Chiapas and Central Guatemala; between which two districts they are broken through by the depression of the Peten. In Honduras and Nicaragua they play a part of diminishing importance. In the former, the Esquias range shows a north-to-south strike, which seems to point to the conclusion that the remarkable depression which crosses Central America between Puerto Cortez and Fonseca bay may be due as much to tectonic causes as to denudation. In Nicaragua an unusally important part is played by new volcanic outpourings, which seem to have taken place towards the end of the Miocene period. This was a time of renewed great dislocations, which have been the chief agents in determining the present surface features of Central America, though there have of course been more recent oscillations, such as have added to the area of the Yucatan peninsula, and given rise to the present coast conditions of British Honduras. The majestic volcanoes of Central America were likewise found as late as, if not later than, the Pliocene period." Dr. Sapper also deals with the climate and vegetation of Central America, in their relation to the surface features of the land. The popular division of the country into three zones — *terra caliente*, *templada*, and *fria*—depends upon their several altitudes; but the distribution of rainfall depends, especially during the seasons of trade-winds, upon the direction of the mountain ranges. Where the fall is over 80 inches, and is distributed throughout the year, there are rich tropical forests; where it is from 40 to 80 inches, and is interrupted by a dry season, there are light forests of pine and oak; where it is less than 40 inches, there are chiefly savannas.

Canadian Beet Sugar Industry.—The Toronto Board of Trade, in its report for 1900, states that during the year great interest has been taken in the proposal to establish the beet sugar industry in the province of Ontario. The soil and climatic conditions are specially adapted for the prosecution of the industry, more especially in Southern Ontario, which is within what is known as the beet sugar zone, and offers unsurpassed facilities for the production of this commodity. The tests made during the past few years under Government supervision, in various parts of the province, regarding percentage, purity, and yield per acre, have been most satisfactory. Capital, however, is timid, and in connection with a proposal that, in order to give the young industry confidence and establish it on a permanent and satisfactory basis, it should be assisted by the Government, the report adds: "It is gratifying to know that the Ontario Government, as well as the Dominion Minister of Agriculture, are considering what assistance can be granted towards the establishment of what should be a most important industry, offering a profitable field for the employment of capital and labour."

Projected S.S. Service with Mexico.—The Virginia-Carolina Chemical Company, known as the Guano Trust, which recently acquired a large amount of mining property in Mexico, of which about 200,000 acres contain rich and extensive deposits of sulphur, is about to run a line of steamships between Norfolk (Virginia) and Tampico, Mexico. The establishing of this line is necessitated by the working of what are probably the richest sulphur deposits in the world, and will

greatly increase the importance of the former port. A railway is now being built from the mines to Tampico, the nearest port.

ARCTIC.

An attempt to reach the North Pole by means of a submarine vessel is to be made by Herr Anschütz-Kämpfe of Munich, who has given an account of the proposed expedition to the Geographical Society of Vienna. The boat, which is now being built at Wilhelmshaven, will be able to proceed at a depth of 27 fathoms for as long as fifteen hours at a time. It is 70 feet long and 26 feet in diameter; the displacement is 800 tons; the interior capacity is to be 3500 cubic feet. An oil-engine will drive the horizontal propelling screw at about 40 h.p., and the vertical screw, which is to regulate the depth of immersion, at about 5 h.p., by means of a dynamo, large secondary battery, and motors. Herr Anchütz-Kämpfe bases his project on the supposition that the mean thickness of the pack-ice is not greater than 16 to 20 feet, and the average maximum depth not over 80 feet; and that the ice-field is broken at sufficiently close intervals to allow the vessel to renew the store of air at least every fifteen hours. A compass course will be taken from one open space to another; when no such opening is found, the ice will be blasted at a weak place, and a new air supply taken in; in the event of failure to break the ice, the vessel will return to the last open area. Herr Anchütz-Kämpfe expects to encounter neither rocks rising towards the surface, nor icebergs descending to any great depth.

NEW BOOKS.

A Reader in Physical Geography for Beginners. By R. E. Dodge. Longmans, Green, and Co., 1900. Pp. 231.

This book is prepared by the Professor of Geography in the Teachers' College, Columbia University, U.S.A. It does not profess to be a text-book of physical geography, and obviously is not one, for not a few topics usually discussed are here omitted. The object of the book is rather to indicate how the facts of physical geography condition human life and activity, and this object it may be considered to attain in a fairly adequate manner. One special feature of this book, as of so many modern American schoolbooks, is the quality and appositeness of its illustrations. There are about eighty pictures, process blocks from photographs; each one illustrates some special point, no one is superfluous, and most are well printed.

It is not quite easy to see where such a book would fit into a school course. Though written professedly for beginners, the literary style is quite unsuited for young children, and there is a general assumption of knowledge and thought beyond them. One cannot avoid feeling that Professor Dodge is often addressing rather his class of teachers than a junior class in a primary school. Teachers on this side the water will also feel that the book is far too obviously written by a New Yorker for New Yorkers. Spelling such as *neighbor*, *harbor*, *labor*, *favor*; phrases such as 'our Southern Atlantic States,' 'back of the coast,' 'vacant lots,' 'truck farms,' 'the wood is grey and punky'; and the overwhelming predominance of America, and especially New York references to illustrative facts, while probably adding to the value of the book for use in New York, must necessarily prevent largely, if not entirely, its adoption here.

Among points to be corrected we may note the statements that the rainfall in Southern Alaska is 'more than 75 inches of rain on every square inch of surface';

that 'every spring or wet place is one of the beginnings of a large river,' and that 'the Gulf Stream is a branch of the North Atlantic eddy.'

Côtes et Ports français de l'Océan. Le travail de l'homme et l'œuvre du temps. Par CHARLES LENTHÉRIC. Paris: Plon, Nourrit, et Cie, 1901. Pp. 400.

"Everywhere the sea attacks the land and encroaches on it. Everywhere surface waters carry new material to the great common reservoir and create new deposits. Then Man intervenes in this incessant struggle, and by dogged persistence he acquires possession of the littoral zone which is always changing and is in constant peril. Patient labour, continuous effort, ingenious devices, obstinate resistance to an enemy which never tires, such, broadly speaking, is the often heroic history of our sea-coast." It is this history which M. Lenthéric undertakes to tell. As Inspecteur-général des Ponts et Chaussées, and the author of several noted works on similar subjects, he is well qualified to speak with authority.

In a series of well-executed maps, drawn by A. Meunier, the author shows us in *black* the ancient configuration of the western coast of France, and in *red* its present outline. These maps are at once curious and edifying. By the student of Geology or Geography they will be regarded as important contributions to our knowledge of the secular variations of a marine littoral. Take, for example, the map of the Bay of Biscay coast from the Spanish frontier to the mouth of the Garonne. Since Roman days that coast-line has increased several miles seawards. The Roman Atur (Adour) had two of its outlets several miles to the north of Bayonne, and the immense "Région des Dunes" represents a tract of sea into which the Atur flowed. The author's descriptions and maps of changes here and at La Gironde, Poitou, La Rochelle, the Loire estuary, St. Nazaire, Morbihan, and Finistère furnish a most valuable chapter of historical geography.

La Russie à la Fin du 19e Siècle. Publié sous la Direction de M. W. DE KOVALEVSKY. Paris: Paul Dupont. Pp. xx+990.

La Russie Extra-Européene et Polaire. Par M. P. DE SEMENOV. Paris: Paul Dupont. Pp. 242.

These two volumes which were prepared in connection with the Paris Exhibition afford excellent examples of the strenuous endeavours on the part of bureaucratic Russia to make the outside world acquainted with that land. In no other country would such laborious work be undertaken for such an end. The names appended to these works are sufficient guarantee of the accuracy of the contents, and there are probably no other 1200 pages in existence that contain such well-selected, condensed, and useful data about the Russian empire. The first and larger volume deals with such matters in particular as the physical geography of the country, its population and political constitution, the various industries of town and country, the different aspects of commerce and finance, ways and communications, and public instruction. Each of the subjects included in this wide area is treated by a specialist, thus involving the work of some sixty collaborators along with that of the editor-in-chief. Of special interest to the outsider are the articles on the artel, that peculiarly Russian form of mutual benefit association, on the investment of foreign capital in Russian industries, from which it would appear that the French and Belgian capitalists favour mining, the Germans electricity and the manufacture of chemicals, whilst petroleum appeals to the English pocket. But the whole volume will well repay perusal, while students of subjects so far removed as music and crime (*pace* Leo Tolstoi) will find special pages set apart to their interests.

The second and lesser volume is by one hand throughout, and gives detailed information regarding Siberia, the Caucasus, and Central Asia. The range of information is again wide, for in addition to embracing such ordinary topics as physical features, industries, and customs, several pages are devoted to careful studies of the fauna and flora of the various territories, while sufficiently partisan estimates of the effects of Russian influence, especially in Turkestan, are attempted. But the work may well stand as a model of thoroughness.

Le Esplorazioni Polari nel Secolo XIX. Di Luigi Hugues. Milano: Ulrico Hoepli, 1901. Pp. xx + 373. *Price* L. 12.

The Italians, owing, doubtless, to their geographical position, have not hitherto taken much interest in Arctic exploration, but now they have suddenly come to the front, Captain Cagni, a member of the expedition of the Duke of the Abruzzi, having attained a higher latitude even than Nansen, namely 86° 30′. At such a moment an account of previous exploration in the Polar seas should be especially welcome in Italy, and the work of Signor Hugues ought to satisfy the demands of his countrymen, being on the whole both accurate and complete for the period he has chosen, the nineteenth century. The latest expeditions are noticed, such as those of Nathorst to Franz Josef fiord, of Amdrup to the coast south of 69°, and of Peary, Sverdrup, and Stein on the western side of Greenland. One or two errors have crept in, but they are not such as to materially affect the history of discovery. The most serious is the statement that Sir John Ross on his first voyage explored Lancaster Sound to 87° 37′ W.; had he proceeded so far he could hardly have reported that the channel was closed by a mountain range.

Misprints, in the names chiefly of British vessels and explorers, are rather too common. The maps would have illustrated the text more efficiently if they had been larger and contained more names.

In der Sternenbanner-Republik. Reiseerinnerungen von Dr. Carlo Gardini. Translated from the second edition of the Italian original by M. Rumbauer. With 41 Illustrations and a Map. Oldenburg und Leipzig: Schulzesche Hof-Buchhandlung und Hof-Buchdruckerei.

As consular agent of the United States of America in Italy, the author has paid several visits to that country under the most favourable circumstances. On this occasion he crossed the continent to San Francisco by the North Pacific Railway, returning by the most southerly route through Arizona, Texas, New Orleans, and the east coast back to New York. On the whole everything is seen through rose-coloured spectacles, for he is a thorough admirer of the United States and its institutions. He was struck by the energy and zeal with which the American working-man performs his task. The men do not, it seems, lose a minute, and while at work neither smoke, talk, nor sing. But school-children, he thought, were overworked. His ideal of an educational system is only to be found in England, where a reasonable amount of play and exercise are dovetailed into the hours of work. At Saratoga Dr. Gardini interested himself in watching the difference of character between the sexes. This seemed to him almost as great as if each belonged to a different race. In the gay society world of the celebrated Springs the male sex were stiff, silent, and like fish out of water. The women, on the contrary, with their wit, their sparkling flow of conversation, and coquetry, were thoroughly in their element. The ladies of St. Louis, owing to a certain amount of French blood in their veins, are, he observes, darker in complexion and more vivacious in manner than American ladies from the east and west. He seems to prefer them on this account. But he gives the palm of beauty to the ladies of

New Orleans, where he finds the Latin type on the American continent in its purest form.

The first half of the book narrates the railway journey over so well known a route as that from New York to Salt Lake City, where the author has a good deal to say about the Mormons, their history, religious beliefs, and probable future. At San Francisco he made the usual excursions, which are fully described. On his way back, while passing through Texas, he was horrified at the sight of some mounted men, who had just lynched a negro for murdering with great barbarity a white girl. The rest of his journey to New York was uneventful. But all the large towns he stopped at are described at some length.

Egypt and the Hinterland. By Frederic Walter Fuller. London, New York, and Bombay: Longmans, Green, and Co., 1901. *Price* 10*s.* 6*d.*

In his preface to this work the writer, with shrewd foresight, indicates uneasiness as to whether it is really wanted. He himself mentions various standard works on Egypt and the late war, and admits that he has nothing to add to them, but apparently he hopes that this work will be found "short and comprehensive" as compared with them; and if this is all he intended in writing it, his intention may be admitted to have been attained. Apparently what interested him most in Egypt was the Copts, and his brief account of them in the fifth chapter and in Appendix III. is very interesting and instructive. The rest of the book is a sketchy account of the history of Egypt during the nineteenth century, with notices of the improvements introduced by the British in such matters as finance, education, justice, irrigation, and the like. We can recommend the work to any readers who are too lazy or too busy to tackle the standard works of Milner, Silva White, Churchill, etc.

A Forgotten Empire—Vijayanagar. By Robert Sewell, Madras Civil Service (retired). London: Swan Sonnenschein and Co., Ltd., 1900. Pp. xxii + 427. *Price* 15*s.*

Students of the history of Southern India may be sincerely congratulated on the appearance of this excellent work, which Mr. Sewell modestly describes as a contribution to their study. Hitherto the materials for the history of the Empire of Vijayanagar were meagre and confusing, viz., "The scattered remarks of European travellers, and the desultory references in their writings to the politics of the inhabitants of India; the summaries compiled by careful mediæval historians such as Barros, Couto, and Correa, who, though to a certain degree interested in the general condition of the country, yet confined themselves mostly to recording the deeds of the European colonisers for the enlightenment of their European readers; the chronicles of a few Muhammadan writers of the period, who often wrote in fear of the displeasure of their own lords; Hindu inscriptions recording grants of lands to temples and religious institutions, which documents, when viewed as state papers, seldom yield us more than a few names or dates." Now, however, thanks to the discovery in the *Bibliothèque Nationale* of Paris of the chronicles of Fernão Nuniz and Domingo Paes, written apparently between 1520 A.D. and 1536 A.D., the dry bones have been brought to life, and fresh and trustworthy light has been shed on a hitherto obscure chapter of Indian history. As Mr. Sewell remarks, "These documents possess peculiar and unique value; that of Paes because it gives us a vivid and graphic account of his personal experiences at the great Hindu capital at the period of its highest grandeur and magnificence—'things which I saw and came to know' he tells us—and that of Nuniz because it contains the traditional history of the country gathered first-hand on the spot,

and a narrative of local and current events of the highest importance, known to him either because he himself was present, or because he received the information from those who were so." These valuable documents were discovered by the well-known Arabic savant, Senhor David Lopes, and were published by him some four years ago in the original Portuguese at Lisbon. Of course it is impossible for us to give even a condensed account of the contents of these manuscripts, but we recommend them in their English dress with much confidence to all interested in the history of Southern India. Mr. Sewell has prepared a valuable introduction in which he sets forth what can now be confidently affirmed of the history of Vijayanagar, based on a careful study and comparison of all the sources of information which are now forthcoming. His work is enriched with some excellent illustrations and maps.

Handbuch der Seenkunde. Allgemeine Limnologie, von Dr. F. A. Forel, Professor an der Universität Lausanne, mit einer Tafel und 16 Abbildungen. Stuttgart: Engelhorn, 1901. Pp. x+249.

This work forms one of the parts of the Library of Geographical Handbooks, edited by Professor Ratzel, and it fully maintains the standard of excellence, as regards thoroughness of treatment, of its predecessors. Professor Forel is widely known from his systematic investigations in the Lake of Geneva, of which he is publishing a monograph (two volumes having already appeared, while the third is in the press). He has made a profound study of limnology in all its bearings, and the book before us represents the fruits of his ripe experience. The space at our disposal is totally inadequate to do justice to the work, and we shall, therefore, merely attempt to indicate its scope.

Geography, the science of the earth, relates to the study of the lithosphere, hydrosphere, and atmosphere; that branch dealing with the hydrosphere is called Hydrography, and may be subdivided into:—

(1) Oceanography—the study of the ocean;
(2) Limnology—the study of lakes;
(3) Rheology—the study of flowing water on the land-surfaces (rivers, etc.); and
(4) Glaciology—the study of solid water on the land-surfaces (glaciers, etc.).

A lake is defined as an enclosed body of water lying in a depression of the earth, not in direct communication with the ocean; but in order to exclude ponds and swamps, the term lake in its strict sense is limited to such bodies of water as are sufficiently deep in the central parts to exclude the penetration of the littoral flora. The great majority of lakes are open (*i.e.* above the earth), but subterranean lakes are not unknown, though they have never a great extension nor a great depth. Lakes, as regards the formation of their basins and their origin, are divided into:—Tectonic lakes, Erosion lakes, Dam lakes, and lakes of mixed origin.

The greater part of the book deals with the water contained in the lake-basins, which is treated of under the heads:—Hydrology, Hydraulics, Chemistry of the water, Thermal conditions (the majority of the illustrations relate to the march of temperature in the lakes of tropical, temperate, and polar regions), Optical conditions, and Biology. The volume concludes with a programme for limnological investigations, and a bibliography, which, however, does not include a reference to the work of Sir John Murray and Mr. Pullar among the Scottish lakes, the first part of which was published in April last.

We confidently recommend this book to all who are interested in the study of lakes.

NEW MAPS AND CHART.

EUROPE.

FORMA URBIS ROMÆ. Formam dimensus est et ad modulum 1: 1000 delineavit Rodolphus Lanciani. Fasciculus Octavus. Mediolani 1901.

Presented by Mrs. Hugh Rose.

ASIA.

INDIA, Atlas of ——. Whole sheets—15, 17, 44, 61, 88, 94, 102, 106, 116, 120. Quarter sheets — 31 NW., SE., SW.; 48 NW., SE., SW.; 49 NE.; 52 NE.; 53 SE.; 64 SW.; 66 SW.; 69 SE.; 70 SE., SW.; 77 NE; 87 NW., SW.; 126 NE., SE., SW.; 127 NE.; 131 NW.

INDIA, with additions and corrections to railways to 1898. Scale 1 inch = 96 miles.

INDIA, to illustrate gauges of railways corrected up to 30th September 1900. Scale 1 inch = 80 miles.

ASSAM. Scale 1 inch = 32 miles.

BENGAL, BEHAR, ORISSA, and **CHOTA NAGPUR.** Scale 1 inch = 32 miles.

BOMBAY PRESIDENCY, with additions to railways to February 1899. Scale 1 inch = 32 miles.

CENTRAL INDIA AGENCY, with additions and corrections to 1899. Scale 1 inch = 16 miles.

H.H. THE NIZAM'S DOMINIONS, including the Assigned Districts of Behar. Scale 1 inch = 32 miles.

NORTH-WESTERN PROVINCES AND OUDH, with additions to June 1899. Scale 1 inch = 32 miles.

SIND (with additions to 1900). Scale 1 inch = 16 miles.

UPPER BURMA. 2nd edition. With additions and corrections to boundaries and railways. Scale 1 inch = 16 miles.

WESTERN BENGAL. Sheet No. 8. With additions and corrections to railways and boundaries. Scale 1 inch = 8 miles.

Survey of India Department.

AFRICA.

UGANDA, Map of ——. Compiled by Lieutenant-Colonel J. R. L. Macdonald, R.E., assisted by Major H. H. Austen, R.E., and Lieutenant R. T. Bright, Rifle Brigade, from surveys executed by the Officers of the Macdonald Expedition, 1897-98, and other sources. Scale 1: 633,600, or 10 miles to 1 inch. 4 sheets. *Price* 3*s.* each sheet. Lithographed November 1899.

Intelligence Division, War Office.

OCEANIA.

Bartholomew's Chart of Oceania and the Pacific on Mercator's projection. *Mounted on cloth,* 3*s.* 1901. *Edinburgh Geographical Institute.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

INDIA TO ENGLAND *VIA* CENTRAL ASIA AND SIBERIA.

By Major E. J. Medley.

It is many years now since Central Asia and Siberia began to have a peculiar fascination for me, but I had seen little hope of ever being able to visit those parts. In 1895, however, fate sent me to serve on the northern frontier of India, in the Gilgit Agency. Here, in the midst of the mighty mountains of the Himalayas, I passed five years of my life. During these years I have seen from the windows of my house in Gilgit three peaks of over 24,000 feet in height, while within a radius of twenty miles round Gilgit, unseen, but felt, there are said to be sixty peaks of over 20,000 feet in height. Amid such surroundings man feels small indeed, and I began to long for the vast plains, which, commencing from a point some 500 miles north of where I was, stretched, I knew, right away to the North Pole. After some delay and difficulty my desire was at length realised, and permission was accorded me to proceed on leave to England *viâ* Central Asia and Siberia.

Accordingly I left Gilgit and the little colony of white folk quartered there on the 5th of October last, and proceeded up the Hunza valley, which has been rendered famous by Knight in his fascinating book, *Where Three Empires Meet*. From Gilgit as far as Baltit, the capital of the little state of Hunza, there is now a very fair pack road; but from Baltit up to the British frontier, on the top of the Kilik Pass, the road has been well described as the "worst in the world." This badness is due, not so much to the actual condition of the road, as to the fact that, when the pass is open, the valley down which the road leads from the pass is shut, because then the melting snow prevents the valley road being used; while, when the winter comes on and the water in the valley is low enough for ponies to proceed along the bottom of the valley, the pass is then too deep in snow for crossing. Practically, therefore, this road can

only be used with any approach to comfort in the months of October and November, as then the summer snows have melted, while the next winter snows have not yet blocked the pass. I had, however, to start somewhat earlier than at the best time, as I wished to avoid having to travel by sledge in the coldest Siberian winter month, viz., January, and therefore had to time matters so as to reach the railway before the end of the year.

There was something peculiar in starting on a journey of 2000 miles to catch a train, for that was what I was doing, and as the latest information I had anent the through Siberian trains was to the effect that they only ran once a month, I felt that chance would have a good deal to say in the matter.

However, thirty stalwart men of Hunza have shouldered my various packages at Baltit, and we are off for the Far North. I have brought a pony with me, but I feel that in places a cat would be a better mount, and my pony can only negotiate these bad bits with the assistance and support of four men of the country, who hold tight to his head and tail to prevent him from falling off the ledge of a road into the torrent some thousand feet below. The weather is perfect, and when one can ride, one has no desire for anything further in this life: but when, as sometimes happens, the pony has to be unsaddled in order to be taken through the raging and ice-cold river, while we have to swarm up the solid face of a jutting-out cliff for a thousand feet or so, and the faithful Hunza men haul us up in front, or push us up from behind, why, then one begins to feel that a fur coat is somewhat of an encumbrance, and you wish yourself anywhere but where you are at the moment. This upper part of the valley, through which we are now crawling, is usually known as the Gujhal valley to distinguish it from the Hunza valley proper. The Gujhalis came originally from Wakhan, a small Afghan state lying along the banks of the Ab-i-Panj, or Oxus river. Although they have now for many years been subjects of the Thum or Raja of Hunza, and can speak the Burushaski language, yet they still also among themselves to this day speak their Wakhi tongue, which is very like Persian. In this Gujhal valley no supplies of any sort, except perhaps an occasional sheep, can be obtained. The valley, some ninety miles long, is but scantily inhabited, and the sites of the villages have been arbitrarily fixed by nature on the small alluvial fans, where alone can water for cultivation be obtained; and this same cause practically prevents the villages from increasing in size. At certain times of the year all intercourse between neighbouring villages is cut off; consequently it behoves each village to always have a reserve of supplies in its granaries. For this reason the government of India is very loathe to allow travellers to use this road more than can be avoided, and, even when permission is granted, all travellers have to arrange beforehand to carry supplies with them. The scenery is rugged in the extreme. The valley is seldom more than 100 yards wide, and the solid rock cliffs rise sheer up on either hand for some thousands of feet, ending generally in sharp pointed pinnacles, which look for all the world like the gothic towers of some vast cathedral. For the most part the valley is void of vegetation, but now

and then, far up the mountain side may be seen a few pines or cedars, which serve the villagers as fuel. Later on in the year, as I know from previous visits, the cold in the higher part of the valley is intense. The river is then frozen solid, snow lies deep on the ground, and all life seems to come to a standstill. Just now, however, at the time of my journey, the valley is at its best. It is neither too warm by day, nor too cold at night, and when I reach the village of Misgar, 12,000 feet high, the last inhabited spot of the British Indian possessions, and feel that the most difficult bit on this road has been safely negotiated, I cannot help agreeing with my servants and my transport men that "my luck is good." At Misgar I meet a party of pilgrims from Central Asia on their way to far-off Makka, to perform the Hajj or Muhammadan pilgrimage. Like all travellers, they had been detained here by the picket, which keeps watch and ward at this outpost on behalf of the Great White Empress, till her representative in Gilgit should accord permission for them to proceed. As the general permission for pilgrims to use this route had been granted before I left Gilgit, I was able to do these worthy people a good turn, and when we parted the next morning, I for the snows of Siberia and they for the sands of Arabia, they showered blessings on me and on my party, which is accounted among Muhammadans the best "God speed" a traveller can have.

We crossed the Mustagh range by the Kilik Pass on the 16th of October. A recent fall of early snow had made the crossing somewhat tedious and difficult for the porters, but they were all happily brought into camp late that night by torchlight. From the top of the Kilik Pass I got my first view of the Pamirs, than which I can imagine nothing more striking. After the narrow valley of Gujhal, where one feels oneself shut in on all sides by those lofty mountains, you suddenly come out on to the tops of the mountains as it were, and begin to realise why it has been so aptly called "the roof of the world." The Kilik Pass is 15,600 feet high. At its foot, on the north side, lay the valley of the Karachkur stream, down which my road was to lie for some days. Beyond this valley lay waves upon waves of mountains, not rugged and pinnacled like those through which I had just passed, and in the midst of which I had lived for the last five years, but smooth and round, and very little higher than the valley they flanked. While the Kilik Pass and the Mustagh range were covered with snow, the mountains on the Pamirs were almost green, and not a particle of snow was to be seen on them anywhere. On my left, distant not more than some eight miles, was plainly visible the Wakhjir Pass, where China, Britain, and Afghanistan meet, and on the west side of which rises the mighty Oxus river.

We descended the Kilik, and on reaching the stream of the Karachkur, which comes from the east side of the Wakhjir Pass, turned due east, and continued down it for some four miles, till we reached the first signs of Chinese authority in these parts in the shape of the Tajik picket of Balderling. Here we were most kindly received and most hospitably entertained by these denizens of the Pamirs. Seated round the usual, and indeed only possible, form of fire on the Pamirs, viz., one made out

of burtsa and dung, inside a large felt tent or kibitka, the walls and floor of which were covered with rich Yarkand carpets, sipping tea and nibbling at hot rolls, made by the ladies of the house before our eyes, one felt that even the best European hotels could not, at that particular moment, have afforded us greater luxuries or more appreciated comfort. While our hosts are killing and boiling the sheep, with which, as is the custom in this hospitable region, every honoured guest is regaled, a few words may not be out of place regarding the Taghdumbash Pamir on which I now found myself. The valley is about ninety miles in length, stretching from the Wakhjir Pass to the village of Tashkurghan. For the first half of its course it runs due east; it then turns north just before the spot at which the stream from the Kanjarab Pass flows into it. Although it has been visited for the purposes of sport by more Englishmen than any other Pamir, yet, strange to say, it was only properly surveyed by a native Indian sub-surveyor of the government of India last summer. Till this map appears, the only map that travellers and sportsmen have for guide is the map of the Pamirs published by the Royal Geographical Society's Journal, under the supervision of Lord Curzon, which is very inaccurate in many respects. The inhabitants of the Taghdumbash Pamir are Tajiks. These people are the original Iranian inhabitants of Central Asia, and much superior to the Kirghiz in every way, on whom, indeed, they look with great contempt. Unlike the Kirghiz, the Tajiks can almost all speak Persian. The Chinese authorities now use the latter as pickets or guards throughout this district of Sarikol, as they are more reliable and less inclined to wander. These pickets watch all the valleys which lead down from the passes on the Sarikol range, which forms the boundary between China and Russia in this part of the world. They serve another, and from a traveller's point of view a still more useful purpose, however, for they happen to be so stationed as to form convenient halting-places down the valley; and as a kibitka is both more commodious and warmer than an ordinary tent, most travellers prefer to use the pickets as rest-houses. I did so, at any rate, and did not once pitch my tent the whole way from the Kilik Pass to the Russian frontier post at Narin.

To resume my journey. After dismissing my Hunza porters, and arranging with a Tajik for the conveyance of my baggage to Tashkurghan on camels, we started down the valley, and arrived at Tashkurghan, the capital of the district, and the seat of residence of a Chinese Amban or "district magistrate," on the 20th October. Here we were warmly welcomed by the British Indian news-writer who looks after our interests in these parts and maintains the communication between Kashghar and Gilgit. Although for politeness' sake I sent word of my arrival to the Amban, and expressed a desire to see him, I never succeeded in doing so during my two days' halt there; and I learnt that the reason was that he was too busily engaged in gambling with his own soldiers to have time to attend to business. The Chinese officials at these distant out-posts in fact do little else but gamble, the work being done by the Kirghiz Begs in the name of the Ambans. The system seems to suit all parties, for I never heard of any cases of oppression or discontent among these Muhammadan subjects of China.

From Tashkurghan to Kashghar there are several roads. I chose the one by the Gez defile as being the most convenient at that time of year, and the least known to us. For the first few miles we continued down the Karachkur river, which we had followed for so many days. This river then turned east to Yarkand, while we continued north up the valley of the stream that flows down from the Kara Su Pass. At ten miles from Tashkurghan we entered the large plain, some fifty miles square, of Tagharma, where in summer the Kirghiz bring their flocks and herds in thousands to graze. Then on past the giant mountains of Mustagh Ata and Kungur, concerning the duality of which controversy raged so long, and over the ascent of one of which Sven Hedin recently spent so much time in vain. Leaving Little Kara Kul on the right, where the wind blows so strongly all the year round that the lake never freezes over, we reach the fort and lake of Bulun Kul, and turning eastwards enter the Gez defile. For three days we wind our way along the river bed, between lofty, precipitous rocks, through which the road is closed in summer on account of the volume of water, and emerge at length at the village and fort of Tash-Balik, on to a stony, sandy plain, across which our road lies for the next thirty-five miles, the last twenty-five through villages and cultivation, till we reach, late at night on the 30th October, the hospitable dwelling of the British representative, Mr. Macartney, who with his charming wife lives in a converted Chinese house just outside the walls of the Muhammadan city of Kashghar. Here I spent seventeen days, during which I made the acquaintance of the large Russian colony, visited the small colony of Swedish missionaries, and that eccentric but extremely clever Dutch missionary, Father Hendrics. I also called on the Chinese officials, and had the honour of being invited to dinner with the Tao-tai, or Commissioner of the division of Kashghar. There is no need for me to describe a Chinese dinner, it has already been fully written about more than once in recent books of travel; suffice it to say here that the particular dinner at which I had the honour to be present was on the usual pattern; it began with shark's fins, included seaweed, and that great delicacy sucking-pig and crackling, besides some forty other courses, and ended up with the every-day Chinese dish of boiled rice, which notifies that the host has done all he can for you, and it is time for the guests to depart.

From Kashghar I sent my servants back to Gilgit, and started with two Cossack orderlies, kindly lent me by the Russian Consul-General, in company with the monthly Russian post, on the 16th November for Narin.

We followed a large river bed the whole way up to the Pass of Turug Art, by which we crossed the Tian Shan range from China into Russia. Then skirting along the shore of the Chatir Kul, crossed the second range of the Tian Shan by the low depression in it which is not marked on any map, but is known locally as the Chatir Kul Pass. It is at the extreme west end of the lake, can hardly be called a pass at all, being only some 300 feet higher than the plain, and lies on the regular caravan road between Narin and Kashghar.

At-Bashi was reached on the 23rd November. Here resides the

Russian district officer, in charge of the Kirghiz of these parts; his sway extends over 50,000 square miles of territory, peopled by a nomad population, so that his work is by no means light. There is one droshky or cab in the village, which I engaged for the twenty-five miles' drive to Narin, over a country road, lying then deep in snow. After the daily riding, however, the drive came as a welcome change.

Arrived at Narin, I dismissed camels and ponies, sold saddle, bridle, etc., and prepared for the long drive of 1400 miles to the railway along the Russian postal road.

Before starting, however, I will show you a few photos of the journey, as far as we have now come. I regret to say that most of the photos I took between Gilgit and Kashghar were stolen from some boxes I sent home direct from the latter place.

At Narin I was met by a Russian officer, who had been sent to smooth the way for me in case I experienced any difficulty on the frontier. After a day's halt there, during which the local customs officer minutely examined my baggage, more from curiosity, however, than for any other reason, and I had made the acquaintance of the whole of the society of the post, which I found very much like our Indian society on the frontier, my companion and I started by tarantass for Verni. While we jolt along the road, well muffled up in furs, enjoying the bright sunshine and breathing in the crisp, frosty morning air, let me try and describe to you, as well as my poor powers allow, the pleasures of long-distance stage travelling in Russia. Probably many of you, as I had done, have read about it, but so rapidly are railways springing up all over Russia, that soon it will be as unknown there as stage coaching is now in England.

The roads in Asia are not metalled, consequently the going, as long as one is on wheels, is somewhat rough. As soon as the snow falls, however, and the sledges can be used, the journey becomes delightful. At about every eighteen miles along the road there are very decent and clean rest-houses, where one can always get a samovar of boiling water and fresh bread, together with crockery, knives, forks, etc. Here and there, especially where there is a village, and there are many along the route, the traveller can get a chop, or steak, or more frequently an omelette. For the rest, one must depend on one's own stores; but as these can also be procured fresh and good at all the towns on the road, it is better to take as few as possible. I took far too many with me, as, judging from the reports of former travellers, I imagined myself going into a perfect desert; the result was that, what with the hospitality we met with on the Pamirs and being able to procure fresh supplies along the postal road, I was so sick of my tinned stores before the end of the journey that I distributed them to every one I could, only too glad to get rid of them somehow.

These post stations or rest-houses are farmed out to contractors by the postal department for a certain sum, the contractors undertaking to keep up a certain number of horses at each place, and to provide boiling water, bread, etc., at fixed rates. In return, the contractor pockets the money paid by each traveller for the hire of horses and carriage to the next

station, these rates being fixed by the authorities. The rates at which a traveller is called upon to pay are posted up conspicuously in every rest-house, so that there is no possible room for fraud or dispute. The usual method of travelling is to spread one's bedding along the flat, straw-covered bottom of the vehicle, and to travel night and day as long as one can get horses. One eats and drinks at the stations while horses and vehicle are being changed. Each stage is done in about three hours, which, in the winter, is about as much as a traveller can stand without injury from the cold. Should the driver lose his way in a snowstorm, as happened to me three times, and one is kept out between stages for five or six hours, the traveller may very likely lose his toes. How many will probably depend on the severity of the cold. We were fortunate enough to meet with no very severe cold till we reached the railway. The yemshchiks or drivers are chiefly Kirghiz, and no better drivers could be wished for on the wild, barren steppes. When the whole country is as flat as the palm of one's hand, and covered so deep with snow that no landmark of any sort or kind is visible, on a pitch dark night, with a biting wind hurling the falling snow straight in his face, with the telegraph posts invisible at even a few paces' distance, and yet the only mark of any sort in the awful wilderness to give the general direction, I doubt if any human being in the world except a Kirghiz, born and bred on these steppes, could find his way to the next station.

For 180 miles after leaving Narin the road wound in and out among the mountains. Still sitting in the tarantass, we crossed two snow passes over 10,000 feet in height, and emerged at length on to the steppes shortly before reaching Verni. Here we stayed a few days to arrange for our onward progress, and to enable me to get an idea of Russian life in Asia.

Verni, as has been well said, was unknown in Europe until it ceased to exist. It was destroyed by an earthquake, as you doubtless will remember, not many years ago. Since then it has been rebuilt, but almost entirely of wood. The town now numbers some 24,000 inhabitants, more than two-thirds of whom are pure Russians. It is the capital of the province of Semirechinsk, which has lately been incorporated in the Governor-Generalship of Turkistan. Semirechinsk, like all the frontier provinces of Russia which border on China, is extraordinarily rich in minerals, and some day will be better known to the world when it is linked with it by the railway. I may mention that owing to the difficulties of transport the wheat for the last two years has not been cut, and now lies rotting in the fields, as the province grows far more than it requires.

We left Verni on the 7th December by tarantass, but soon met with the snow, and for the rest of the journey travelled on sledges. The comfort of the change is more than words can express; and as we lay back on our rugs and pillows, reading or chatting as the fancy suited us, while the sledge spun along smoothly over the crisp, hard snow, we felt that life had not yet exhausted all its pleasures.

Travelling without stoppage, except for meals and to change horses and sledges, we reached Kopál on the 10th, Sergiópol on the 14th, and

Semipalátinsk on the 16th December. Here we halted for three days to give ourselves and our clothes a much-needed wash.

In the summer the best way to go from here to the railway is by steamer down the river Irtish. When we were there this pleasant mode of travel was denied to us, as the river was locked in the icy grip of winter. The post goes along the road down the right bank of the river to Omsk. This road is not particularly interesting at any time, so we decided to take the road by Barnaul, which looked as if it must get us to the railway somewhere, though exactly where we could not find out. The good people of Semipalátinsk have been so long cut off from the outside world, that, though the Siberian railway has now been open for five years, they hardly yet seem to be aware of its existence. At any rate to our inquiries about trains, etc., they politely responded, "I don't know," and seemed much astonished that we should expect them to know. In fact, when I remonstrated with them on their ignorance about a railway which was so close to them, they simply stared and said, "Close? Why, it is 450 miles away." "Oh, that is nothing," I replied, "I have come 1500 miles to catch the train, so it seems close now to me."

Accordingly, when we left Semipalátinsk on the 19th December on the last stage of our long posting journey, we were in pleasing ignorance as to where exactly we should strike the rail, but hoped to get some definite information on the point before long.

The country through which we were now going was quite different from anything we had seen before. Instead of the valleys and mountains of the Tian Shan, or the level steppes of Central Asia, we now found a pleasing mixture of both on a small scale. Where before we had never seen a tree, except high up on the mountain-side, or in an artificial grove, where they were being carefully nursed by the Russian forest officers, here we began to go through the outskirts of those enormous Siberian forests, which later on we were to see for days together from the railway carriage. In place of the wandering Kirghiz of the steppes, with small Russian colonies sandwiched in between at long intervals, looking as if they had only just arrived from Europe, and not quite certain whether they liked the change, we now found at every station a large and flourishing colony, two hundred and more years old, all peopled by pure Russians, with never a native of Asia to be seen anywhere. And yet somehow these Russian villages were unlike those in Europe. Here we found broad streets, lighted with oil lamps; our old friends the village church and bath house were there certainly, but there were also schools, and the public-house didn't seem to occupy so large a space as in European Russia. Also these houses were trim and neat, and when we went inside, instead of the two dirty dark rooms, with the whole family asleep on the stove, we found pretty little furnished and clean rooms, that would do credit to any well-to-do farmer in Great Britain. The truth is that the Russian peasant in Siberia has been for so many years quite cut off from all government assistance that he has had to work out his own salvation, and well has he risen to the occasion; so that now, when he is at length being discovered by the traveller from the

outside world, he appears to belong almost to a different race from the ordinary Russian Muzhik.

On the 20th December we passed through the curious little town of Zmeinogorsk, with its 7000 inhabitants and the fine pile of buildings where at one time the silver-mines were in full swing. Near by here is the active volcano of Kara-Ul, 2000 feet high, behind which on a clear day the range of the Altai mountains is clearly visible.

The 22nd December sees us at Barnaul, famous for possessing one of the finest mineral museums in the world, where some small idea of the latent riches of the Altai can be obtained.

At Barnaul we came upon the first traces of the railway in the shape of a time-table hanging on the wall in the rest-house; our excitement was intense, we were now only 150 miles from the rail, and hoped in twenty-four hours to be in a train. Barnaul, however, had discovered the railway in order to make use of it, and we were delayed at every yard of the road by long lines of sledges, packed with frozen carcasses of animals destined for the Tomsk and Irkutsk markets. At length we reached the last postal station at which we were to change horses, and from there drove straight down the frozen river Ob, through the new town of Novo-Nikolayevsk, barely two years old, but already numbering more than 15,000 inhabitants, and which has quite supplanted Krivoshchekovo as the eastern end of the West Siberian line, and finally drew up at the large, handsome station of Ob, on the right bank of the river of that name.

Having at length reached the Siberian railway, and as you are probably as tired of my journey as I was myself, I propose to break it off here, and to give you a slight general description of Siberia and the Great Siberian Railway. Before doing so, however, I will show you a few more slides connected with the road over which you have so kindly accompanied me on sledges.

Time will not permit of my giving you anything more than the roughest outline of Siberia and the Great Siberian Railway, and I would not venture to do even that, but for the extraordinary ignorance that exists, I do not say among geographers and learned societies, but among even well-educated people in Great Britain, with regard to almost everything connected with Siberia.

Political Siberia, which also corresponds very fairly with physical Siberia, is about 248,000 square geographical miles in extent, and lies between 45° and 77° of North Latitude, and between 30° and 160° East Longitude. Its land surface is about one-thirteenth of the land surface of the whole earth, or about twenty-five times the size of Germany.

With such a vast extent of country it can easily be imagined that there is great variety not only of surface and geological structure, but also of climate, fauna, and flora. Time does not permit of my doing anything more than to indicate in the briefest way possible the general characteristics of these variations.

Roughly speaking, it may be said that the country divides itself into three zones. The first or southern zone is what we may call the

agricultural zone in West Siberia, and the mineral zone in East Siberia. Next is the middle or forest zone; and lastly the zone of the tundras, where the earth, at a depth of one foot below the surface, remains always frozen. Next, considering the configuration of the country from west to east, we find that West Siberia consists almost entirely of plain, which for more than 1000 miles stretches eastwards with but an occasional hill of some 500 feet in height to break the monotony. Very different is it in East Siberia. Here we have long stretches of hills, rising sometimes even to mountains, and interspersed with thick forests, stretching for many hundreds of miles, the whole ending finally with the thickly wooded mountains round Lake Baikal, which attain an altitude of some 6000 feet. Beyond Lake Baikal the country is entirely mountainous, and this characteristic prevails almost right up to the Pacific Ocean.

With these few words as regards the natural features of the country, let me now pass on to the railway, which has, it may almost be said, been the means of making this vast country at all known to the great majority of us.

The first stone of the Great Siberian Railway was laid by the present Tsar of Russia on the 31st May 1891 at Vladivostok when he was returning to Russia across Siberia after his trip to the east. The line was divided for purposes of construction into several sections, but certain of them being recognised as more important than the others, were constructed first. These were the West Siberian section from Chelyabinsk to Ob; the Central Siberian from Ob to Irkutsk; and the Usuri section from Vladivostok to Khabarovsk. In the second rank came the Zabaikalsk (Trans-Baikal) section from Misovaya to Sretensk. Finally the remaining sections "round the Baikal lake" and the "Amur river," being the most difficult, were left to the last. Up to the present time all have been completed but the last two sections.

Since the original project for the line was conceived, more detailed surveys have shown the enormous difficulties that will have to be overcome in making these last two sections. When these became known to the Committee charged with the construction of the railway, they set about devising other means, whereby through-communication from Europe to the Pacific Ocean might be established. As regards the break at the Baikal lake, attempts are at present being made to pass trains across the lake all the year round on ice-breaker steamers. Two such steamers were built last year at Messrs. Armstrong and Co.'s. These were taken out in pieces and put together on the lake. One of these steamers can carry a train of fifteen cars, while the other will carry passengers only. This winter the large steamer broke its shaft, unfortunately, in trying to cut its way out of Misovaya harbour, and communication across the lake by steamer was consequently stopped for two months. By next winter a new harbour will have been constructed to the south of Misovaya, with none of the disadvantages of the latter, when I have little doubt that the steamers will be able to do all that is demanded of them: through-communication will thus be assured, and the round the lake line will then be made at leisure and as money is available. It will

take both time and money, as the line has to be cut out of solid rock almost the whole way.

Finally, with regard to the Amur river section. By a treaty with China, Russia has been permitted to make a line through Manchuria direct to Vladivostok, with a branch to Port Arthur. A glance at the map will show you that this is the shortest and most direct route that any line could possibly take. It had been anticipated that direct through-traffic from Europe to the Pacific Ocean would have been opened before the end of the century. Unfortunately the Chinese a year ago so wrecked the Manchurian section, that the line has had to be relaid almost throughout. The three ends of it are now, however, open, and if all goes well, it is pretty certain that a year hence one will be able to book straight through from London to Port Arthur.

The Manchurian line takes off at a place called at present "Change-here-for-China," which is 70 miles east of the town of Chita.

The Amur river line, there is little doubt, will be built at some no distant date, though it will not be used as the through-line. The whole of the Amur region is full of gold, which may be said at present to be almost untouched. Similarly the other gold-bearing parts of the country are equally awaiting railway communication before they can be properly worked with large and modern machinery.

The distances along the Siberian railway are as follows:—

Chelyabinsk to Ob, 887 miles; Ob to Irkutsk, 1145 miles; Irkutsk to Baikal, 40 miles; across Lake Baikal, 60 miles: Misovaya to Change-for-China, 520 miles; China station to Vladivostok, 1180 miles (*viâ* Manchuria), 2110 miles (*viâ* Amur). The total length of the line from Moscow to the Pacific Ocean will therefore be about 5200 miles *viâ* Manchuria, or 1000 miles less than by Amur river route, which will account for Russia's desire to get Manchuria.

At present through-trains run twice a week between Irkutsk and Moscow. They answer in every respect to the descriptions given of them recently in the English press.

The traffic that has sprung up since the railway was opened is almost incredible. There is no need to go into figures here, but I would mention one item, viz., the colonists from European Russia, more than one million of whom have emigrated to Siberia since the railway opened in 1896. This state-aided emigration cannot but have a very great influence on the development of the country.

Those who are only now discovering Siberia, since they have been brought into closer contact with it as it were by means of the railway, are much astonished to find it already so developed. The reason, I think, may be found in the system that has prevailed for some years in Russia of deporting to Siberia the political exiles. These people may almost be said to have represented the brains of the country, and as they had to live in those distant regions, they made the best of their fate, and built towns, founded universities and museums, and generally did what they could to make life as pleasant as possible. The consequences of such action are only now fully realised when the railway may be said to have made the outer world acquainted with their work.

In conclusion, I would say a few words as regards the future of Siberia, and more especially with regard to the part the Britishers are likely to play in it.

Hitherto our merchants may be said to have ignored the very existence of Siberia. The only article of British manufacture I met with during the whole of my journey in that country, besides the two steamers on Lake Baikal, was a filter. German and American goods, on the other hand, are plentiful.

Is it wise on our part to make no attempt to get into touch with Siberia?

It is not for me to answer this question. I have, I hope, given you some slight food for thought by attempting to the best of my ability to show you what that country really is.

CYPRUS OF TO-DAY.[1]

When Cyprus passed into English hands at the Berlin Congress, great hopes were cherished for the future of the island, and it was expected that immediate prosperity would follow the overthrow of the Turk. To-day, after twenty years of conscientious British rule, the Cyprian-Greek party assert that the English are harder masters than their predecessors, and that the islanders are worse off than they were before. An outsider who had not observed the condition of things for himself would conclude that both parties exaggerated: but to one who has seen the people and the country, the scale inclines considerably in favour of the English. One must remember how many factors—land, climate, national character, etc.—have to be taken into account; how complicated their relations to each other are; and how much easier it is to criticise than to readjust. Even the passing traveller cannot fail to remark that much has been done for the good of the country, if he compares it with Turkish conditions on the opposite mainland or with Greek methods.

The English are handicapped in their work: first, by the nature of the soil and the harm done by reckless deforesting: secondly, by the peculiar national character and the mixture of races and religions; and lastly, by political conditions, which, while the 'Far East' is so prominent, prevent the 'Near East' receiving as much attention or money as the home officials would like.

Any one who connects the idea of luxuriance and fruitfulness with Cyprus will be astonished at the amount of barren land, not only in the hot season, but at all times of the year. Great emphasis is always laid on the fact that a considerable proportion of the land is not cultivated; but the value of this uncultivated land is very differently estimated. It

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[1] Abridged from an article by Dr. Otto Maas, of Munich, in the *Geographische Zeitschrift*, Dec. 1900.

is always possible to say that the proportions are better than they used to be: that now two-thirds is cultivated instead of one-third; but these figures include only cultivable land, and would appear much less favourable if they included all land totally unfit for cultivation, which is of much greater extent than is generally known (perhaps seven-tenths). When Gaudry says that Cyprus, because of its orographical conditions and geological formation, possesses very varied soil of great fertility, and that the rivers, like the Nile, bring down every year rich mud from the hills; we may say, on the other hand, that just because of the orographical and mineralogical conditions, there are great stretches of very barren land, due to the height and steepness of the mountains and the impossibility of cultivating limestone. Two mountain systems determine the configuration of the island: first, the Troödos in the south and west, with spurs radiating in all directions from the central peak; and second, the mountain chain which runs along the north coast. The latter has no special name, and is always called the north chain. Its backbone is limestone. Its rocky peaks, which rise to 3000 ft., present a most picturesque and seductive aspect to mountain-climbers, but do not attract the practical farmer or forester. The height and ruggedness of Troödos render its slopes equally barren. The country around these ranges is even worse. The north chain is surrounded by sandstone, and the lime and marl around the Troödos give the impression in the distance of artificial whitewashed walls.

The depth of the soil is also disappointing: not only on the higher plateaus, but also on the slopes and lowlands, it is often almost or altogether washed away by the violence of the rains, so that the bare rock is exposed.

The principal fertile region is in the Mesaorea, the plains between the mountain ranges watered by several rivers. But here too there are great barren stretches which increase the drought in the more fertile lands around them.

The lowlands south of the lime and marl zone are widely cultivated; but the most delightful and fruitful part is the north coast. There is only a narrow strip between the rugged limestone hills and the sea, but here there is always vegetation even when all the rest of the country is burnt up. There is always water in the deep gullies of the northern slopes, and its effects are seen far down the valley.

Suitable irrigation is the whole secret of farming in Cyprus; with it the orchards and fields are marvellously luxuriant; without it they become deserts.

Most travellers visit the island in spring, and see green fields and blooming flowers, but experience nothing of the other aspect of the climate and the effects of the burning sun; hence their glowing descriptions of mild air and flower-carpeted country. Those landing on the island in early autumn are painfully impressed by the universal drought. For then even cultivated parts are bare and indistinguishable from desert. The shrubs which remain are grey and dry, and the gullies and slopes of the mountains are bare, except for a few miserable pines: and the four and a half hours' drive from Larnaca, the port, to Nicosia, the

capital, passing across the flats near the sea, the spurs of the Troödos, and then the Mesaorea, is like a desert journey.

This desert appearance passes off very slowly during autumn; for a long rainy season does not come suddenly, but first there is one great autumnal thunder-shower, then after some weeks a second storm, then again, after a shorter interval, a third, and finally it rains several times every week. Even then it never rains all day long, but almost always in short showers. This fact should be emphasised; in the first place, because we are often told that it rains thirty to forty days without ceasing, which the reports of English officials say is quite inaccurate; and in the second place, because the ground, the animals, and the plants have all adapted themselves to this gradual rainy season.

During one winter which was said to be typical, October, except for two thunderstorms, was cloudless, and November was mostly bright and warm, though more broken by storms. On November 24 a decided change set in, rain and cold increased, and fine days were fewer: but by Christmas the worst weather was over. After that there was a longer period of fine spring weather, and finally in February a second rainy season.

There are two distinct rainy seasons, one in autumn and one in early spring: the farmer distinguishes them clearly. The spring rain affects the quantity and quality of his crops, but the autumn rain makes it possible to sow, and he watches for it with great anxiety. There have been years when it has failed altogether or has not been sufficient to penetrate and loosen the soil for the plough, and in consequence there has been famine. If, on the other hand, this autumn rain is abundant, the effect is seen at once. The ground which was impenetrable and cracking becomes loamy and soft. Frequently one notices that the water lies in the low field paths instead of distributing its moisture over the whole soil. The irrigation department has done a great deal, but much has still to be done in regulating the water-supply. The streams which one could cross dry-shod yesterday are full of water to-day, though they may not have begun to run. Even the largest streams, the Idalia and the Pedias, which drain the Mesaorea, are not in the full meaning of the word rivers even at the rainiest time, and their water runs short again surprisingly quickly. Here comes in the work of irrigation: first, to lessen the devastating effect of the water; secondly, to store it up in canals and reservoirs; and thirdly, to distribute it over the fields. On the Idalia near Kuklia such works are in great measure going on: and dams, sluices, and canals managed by experts give employment to many natives

One remarkable effect of the rainy season should be noted: it is the formation of great salt lakes, especially near Larnaca, which dry up in summer and form great salt caldrons. In winter the shallow basin gradually fills up, having apparently an underground connection with the sea. Investigations carried on at my suggestion by the government of the island proved that the salt in the lake was due to this and not to the wasting away of a stratum of rock salt. In the barren region round Larnaca, the appearance and growth of this lake basin affords a most pleasant change.

The greatest change caused by the rain in the appearance of the country is that of the vegetation; but this is gradual, corresponding to the irregular rainfall.

Grasses and dwarf shrubs are the first to recover from the drought of summer. Single branches throw out buds, during the rain they get green and bloom, until the next rain the fruit is as dry as the rest of the shrub, other branches begin to sprout, and at last the whole plant is fully out. The tender green of young grain is to be noticed even in December as a gentle down on the broad plains. The commencement of the rains releases many animals which take a summer or rather drought sleep. Dr. Maas found a number of beetles in autumn quite baked into the hard earth, just as if they were dead; when the rain came he saw them gradually waken in the softening earth, and then, covered with mud which they did not lose for weeks, begin to crawl about.

The temperature, which is very high in summer, falls very gradually, and remains remarkably high during October. The surrounding sea cools off very slowly. In the middle of December a sea-bath was no hardship, and only light summer clothes were worn.

The snowfall is, of course, very small. The plains are never really covered; the hills only for a very short time; and only the highest peaks of the Troödos all winter. One very cold December day the peak of the Macharias was covered down to 3600 ft., but only for four days; the north chain has sometimes its peaks snow-clad too, and in general one may say that the snow-line comes down to about 2700 ft.

From a sanitary point of view, Cyprus is better than its reputation, which it derived from the great mortality in the first English garrison. Lately this bad name was confirmed when the Russian colony of Dukabors was thinned by fever. One must remember that in both cases there was a large number of immigrants, and that they came in the hot season, and were living under unfavourable conditions.

Fever does still occur, but not so badly as in other Mediterranean places which have a better reputation. In this connection English rule has made great improvements: by draining the swamps north of Larnaca, and in other districts. The next to go will be the lake of Paralimni, and its flat basin will be redeemed for agriculture.

In general the climate is very bearable; some of the natives live to extreme old age, and it is a good place for lung patients, because it is possible to be constantly out of doors. As yet accommodation for invalids is not very adequate, but various undertakings are spoken of.

Since the worship of Astarte there have been many changes of race in the island, and each has left its traces behind. To the traveller the most striking are those of the middle ages: buildings of the romantic age of chivalry and of the days of Venetian rule, signs of changes under the Muslims mixed up with Greek remains, and here and there very ancient traces of Phœnician or even earlier times, these stamp its history on the island and strike the traveller with awe. But testimony of this sort is only written in stone; from the people one could never guess it. It is a race of little originality, perhaps because it is so mixed; unimpressionable and sluggish, perhaps because of its very

ancient culture; and of little energy, perhaps because since the days of the old Egyptians foreign lords have always ruled over them. It is true that in the peninsula of Karpas there is a strong, blonde type, probably descended from the Frankish crusaders; it is true that in the towns many of the gentry pride themselves on their Greek ancestry; it is true that the better class of Turks preserve their racial dignity in bearing and appearance; but, on the whole, it is a featureless, needy people, who, whether Christian or Muhammadan, lead a very simple life. It is therefore difficult to improve the condition of the people, although agricultural products are saleable and could easily be much increased, for they only consider their own needs and the nearest markets. But here English control and the English market have been of some help. The grain is of excellent quality in spite of the simplicity of the husbandry, and English brewers purchase more barley than is here produced. The same is true of the carob fruit, which English and French merchants will buy in any quantity as food for cattle in the winter months. Thanks to English shipping facilities, this export has gone up considerably. The carob tree is ideal for the Cyprian peasant; it has to be grafted once, and after that is left to the care of heaven. On the other hand, the Cypriot is ill adapted to the wine-trade, which requires extreme care of the vines and absolute cleanliness in making and keeping. Although the high Turkish tax has been abolished, and the government encourages wine-making, that industry has gone steadily back, and the Cyprian growers have even lost Egypt, which was their market for cheap wines.

The country is well suited for the cultivation of cotton, which does not require much care, grows well high up, and only needs to be watered. It is to be hoped that the improvements made in irrigation by the English will encourage a much larger crop.

Formerly Cyprus did not grow a tenth part of the tobacco used on the island, but now that the high tax has been taken off, it is largely cultivated.

Some districts are taking up fruit-growing, and export oranges, lemons, and other fruits.

Better markets and increased production will do the people little good unless the activity of native middlemen and usurers is checked by some system of loans under governmental control. It is very doubtful how this remedy could be carried out, though it is eagerly desired. In spite of the higher prices for their products, the peasants are not better off, but worse; for their wants have increased on an even higher scale. They used to burn home-grown olive oil in iron lamps, and the women went about in a costume of flax or cotton grown and spun at home; now the peasant must burn candles, buy gay stuffs from Europe for his wife and daughters, drink out of cups, and eat off porcelain. He gets all these things on credit from the merchant in town, so he has to pay 2 piastres instead of 1 for a candle, 30 instead of 20 for a dress, and the merchant forces him to take other rubbish which he cannot use. So the peasant runs up a big bill; but when harvest has come, the merchant undervalues his agricultural produce, buying the Turkish

corn-measure (22 oka) at 18 to 21 piastres instead of 20 to 25, etc. Then the government dues have to be paid in cash; and the peasant borrows the money for four months at 10 to 12 per cent. What is the result? After a bad year the man cannot pay, he is taken to law, his belongings are sold by auction, and he becomes a day labourer. These merchants and money-lenders do not come from the mainland, but are native Cypriots.

It will be seen that Cyprus is not quite a suitable place for settlements of persecuted foreigners. A colony of Maronites in the north-west of the island promise well: they are industrious, they are on fairly good terms with the members of the Greek sister church, and are easily satisfied.

It was not only the climate which forced the Russian sect of Dukabors to migrate again after the tragedy which befell them some years ago. This ambitious, active, and industrious people felt that the prospects of acquiring wealth were not great, and migrated from Cyprus to Canada. Then various Jewish relief committees have fastened their eyes on Cyprus as a place for agricultural and industrial colonies: but the government, though not hostile, does not encourage these projects. The effect of such colonies on the native population is doubtful, even though the most modern and scientific agricultural methods were introduced.

Among the natives there are some rich men, such as the merchants mentioned above, and there is money in other unexpected places. It is well known that more money comes to the island than is taken from it or is put into circulation. The explanation is that they still bury their money; often a son, when his father dies, does not know the *cache*; and later races may dig up sovereigns with the Queen's head, as we to-day find Greek and Venetian coins.

But riches are the exception, and poverty is general. There is a tendency to socialism, which has sprung up independently of western influence, and resembles early Christianity.

Communism is strongest among the fishermen, and the foundation of all their tirades is that one man has no right to be better off than another. Beggars take up a similar position; but there is less begging in Cyprus than anywhere else in the East, thanks as much to English rule as to local conditions. What beggars there are, claim alms as a right.

In spite of the protests of demagogues, it is clear that the island must be governed in a mildly autocratic manner, and that the people are scarcely ready even for partial self-government.

They have no military resources. The governor is nominally commander of the forces; but the garrison has been almost altogether withdrawn, and numbers less than 100 men, the others being mainly police. In fact, the highest office is now purely administrative and civil, and is occupied not by a general but by a colonial official.

The chief difficulty lies in administration; the district commissioners have full power, and require great circumspection and tact. These district commissioners rank above the heads of the administrative departments, such as public works, irrigation, and revenue.

The official machinery is very simple—a matter of the utmost importance, because the use of three languages (Greek, Turkish, and English) necessitates a great deal of writing. The boundaries of the six divisions—Nicosia, Larnaca, Limasol, Papho, Kyrenia, Famagusta—are almost as they were under Turkish rule; the only change that has so far been made is that the seat of government of the Troödos and the Bay of Morphu has been moved from the district of Kyrenia to Nicosia. In municipal government it is attempted, especially where some of the subordinate officials are natives, to introduce both Greek and Turkish elements; because this arrangement is fair; and because it is found that from jealousy and distrust they watch each other very closely, and so check the irregularities of the Greek or the corruption of the Turk. In courts of law there are also grounds for this double system. Considering their mutual hatred and alienation, it is reassuring to the litigant to see a Greek and a Turk in national dress sitting beside the English judge. There are some very clever, well-read native advocates, and a number of others belonging to Levantine families in the port towns; these latter have studied in Athens or Paris, have achieved an inferior degree, adorn their idleness with a title, and often stir up discontent by political agitation.

Several people have pointed out the preponderance of Turks among criminals. After carefully studying the "black books" of several districts, Dr. Maas thinks that this is because Turks as a rule commit easily detected crimes, like assault, whilst the Greek-speaking part of the population cultivate secret frauds and thefts. He noticed that a surprisingly large number of Greeks were convicted for using false weights and measures.

Dr. Maas was present at a number of civil and criminal cases, and questioned the natives about the course of justice. The judges endeavour to be thoroughly at home in the language, and also really try to understand the very difficult conditions of the East, and when at all possible consider special circumstances rather than the exact letter of the law. Many instances might be quoted in which evidently the first consideration has been to spare the national susceptibilities and to pass no hard sentences. Some may have gone too far in this direction, but it is characteristic of English colonial rule that it is always considerate.

There is no doubt that this spirit of conciliation has been appreciated, and that an increasing confidence in the administration is expressed among the lower classes. Nevertheless there is a discontented national party who regard the English as oppressors to be got rid of like the Turks. This movement is not altogether spontaneous, but is stirred up by emissaries from Greece. It is part of the political wave which has made Crete half independent. The extreme party demand independence, self-government, and annexation to Greece. The movement is supported by degenerate Cypriots who suffer from want of occupation and wish to see themselves in the posts of the English. The example of many Balkan states shows that then everything would be open to rank and influence, and that the poor people would be badly off with their half-educated lords.

Still this faction has to be reckoned with, and of course all discontented people join it.

If one wishes to take a general view of the effects of English rule on the island, one need only call to mind what pleasure-seekers and scientific travellers suffered under Turkish rule, the suspicious attitude of the officials, the hindrances which backsheesh could not always surmount, the friction with the natives who acted as boatmen and drivers. The traveller is very conscious of the change now. He notices at once that public order is kept, English officials give every assistance to students of every subject and every nation, and the feeling of security is so great that ladies cycle freely in the country roads. The roads used to be only tracks, which were sometimes even impassable on foot. Such paths are only found now in mountain districts, and are known as "third-class" roads. The principal places are now all connected by "first-class" roads, which four-horse carriages can drive along. Between Larnaca, the port, and Nicosia, the capital, there is regular postal communication. The postal service from Europe is not good; this is due to the irregularities of the steamers and the economy of the Colonial Office.

The Colonial Office a short time ago decided to enlarge greatly the commercial possibilities of Cyprus; they were to put in order the old deserted harbour of Famagusta, which without great expense could be made one of the best in the Mediterranean. Cyprus then would have received that importance as a strategical post which was so much emphasised at the time of the occupation. When the harbour was finished there was to be a railway to the capital, and other railways were to follow. Rents in Famagusta and the hopes of the inhabitants rose disproportionately high: merchants from Larnaca were already making delivery; when suddenly the plan fell through, and the Colonial Office, burdened by South African affairs, spent the money elsewhere. The friends of the island are not all agreed that a railway is its greatest need, and think that the money might be better spent on irrigation.

During the last few years much has been done for hospitals by private capital; and medical conditions will be better still when all the practitioners who date from before the occupation have been superseded by younger physicians.

The tribute which has to be raised every year for the Porte hangs like a drag on the whole system of administration and on all plans of development. Cyprus is still nominally a constituent part of the Turkish Empire: and, besides having the right to make certain appointments, the Sultan still receives £95,000 a year, which has to come out of the revenue of the island, and is a very heavy burden both to people and government. The taxes cannot be expended on the country, and go to fill the money-chests on the Bosporus. The national party make a very strong point of this. It is a question whether, in consideration of the political importance of Cyprus, England should not make an effort to free the island from this yearly tax.

Cyprus cannot hope to spring at once to great wealth and prosperity, but a gradual advance on sound lines may be confidently expected.

BRITAIN'S SUCCESS IN EGYPT.

By Ralph Richardson.

By a somewhat curious coincidence, Lord Cromer's gratifying Report on the British administration of Egypt and Professor Brunhes's important article on "La pénétration anglaise en Égypte" were published upon almost the same day in April 1901. Both writers arrive at the same result, the success of Britain in Egypt, after an exhaustive examination of the British occupation; indeed, one might fancy that Professor Brunhes had previously seen Lord Cromer's figures, and that Lord Cromer had adopted Professor Brunhes's conclusions. Yet the two authorities approached the subject from very different standpoints, Professor Brunhes looking at Egypt in British hands with the supersensitive, hypercritical mind of the Frenchman, whilst Lord Cromer speaks with the satisfaction, yet modesty, of an Englishman who, placed in a difficult position, has achieved a signal success.

Let us glance first at the article which appeared in *Questions Diplomatiques et Coloniales*, published at Paris on 15th April 1901, contributed by Monsieur Jean Brunhes. Professeur de Géographie à l'Université de Fribourg (Suisse) et au Collége libre des Sciences sociales de Paris. It is entitled, "De quelques formes spéciales de la pénétration anglaise en Égypte," and its author commences with the statement that, however much Egypt may present a French aspect to the tourist newly arrived there, the fact remains that Egypt is daily becoming more and more Anglicised.[1] He adds: "Depuis la conquête du Soudan et l'affaire de Fachoda, la pénétration anglaise est devenue plus active que jamais." Professor Brunhes then endeavours to point out the principal occurrences which have led to British influence supplanting French influence and becoming paramount in the valley of the Nile.

He emphasises four special circumstances which have contributed to increase and strengthen Britain's position in Egypt, viz. :—

1. Her services in extending Irrigation.
2. The greatly increased learning of English in schools.
3. The capital invested by British subjects in Egyptian enterprises.
4. The thousands of British [2] tourists induced annually to visit Egypt by Cook's Tours on the Nile.

Both Lord Cromer and Professor Brunhes dwell particularly upon the splendid work done by the British in assuring to the Egyptian peasant that *sine quâ non*, water; Lord Cromer remarking that he was frequently told by small cultivators in bad seasons that "the British

[1] In his speech in May 1901, when laying at Alexandria the foundation-stone of the British School of Egypt, Lord Cromer remarked: "It cannot be too clearly understood by the natives of this country that it is in no way the wish or the intention of the British government to use its influence in the direction of Anglicising Egypt."

[2] This should rather be "English-speaking tourists," for I observed on the Nile steamers that about one-third of the tourists was British, one-third Americans, and one-third other nationalities.

engineers would pull them through the crisis, and save them from destitution and possibly from starvation." His lordship adds: "It is hoped that the Assouan and Assiout dams will be finished before the flood of 1902. The summer supply of water for Lower and part of Upper Egypt will then be assured." It is not surprising that the fellaheen should venerate their British overlords, seeing that the latter are doing for them what no other potentates ever did, bestowing upon them that priceless gift, a *summer* supply of water.

Professor Brunhes next details the steps by which the British administration has arrived at placing the English language on an equal footing with the French in all the educational institutions of Egypt, and he remarks that "depuis la conquête du Soudan, par une conséquence facile à prévoir, la langue anglaise l'a définitivement emporté sur le français. Les Égyptiens s'accoutument ou se résignent de plus en plus à la domination d'Angleterre: Omdurman et Fachoda ont marqué de véritables défaites pour la langue française en Egypte." He then furnishes statistics showing that in 1889 74 per cent. of the pupils in Egyptian schools attended the French sections and only 26 per cent. the English, adding that "en 1898 commence la vraie déroute du français et elle est incroyablement rapide." In that year only 33 per cent. of the pupils attended the French sections and 67 per cent. the English, whilst in 1899 only 22 per cent. attended the former and 78 per cent. the latter. The fact is that the parents of the young Egyptians wisely desire their children to learn that language which will be of most service to them in after life, and that language is now the English.

Professor Brunhes proceeds to his third point, and maintains that, by means of British financial operations, Egyptian territory and interests have largely passed into British hands. He instances the construction of the Nile dams at Aswan and Asyut as having been financed entirely by London bankers, who, having lent the Egyptian government £4,000,000, Mr. John Aird was employed to execute the works. He complains that the French "Crédit Lyonnais," which, he says, is the strongest financial institution in Egypt, now finds itself confronted by a rival favoured by Government in the "National Bank of Egypt," which has its headquarters in Cairo, an agency in London, and a branch at Omdurman. He asserts that in 1898 the only line of Egyptian steamers, the "Khedivieh," was acquired by a British company, "par suite d'une opération plus que douteuse." According to him, a new Anglo-Egyptian company is being floated nearly every month; one, "The Egyptian Markets, Limited," having been officially declared the "concessionaire des principaux marchés dans les villages de toute l'Égypte," whilst another, "The New Egyptian, Limited," has a capital of £500,000, and has "créé deux sociétés filiales qui se sont partagé la tâche et le butin: l'une s'est reservé l'Égypte (*The Anglo-Egyptian, Limited*) et l'autre le Soudan (*The Soudan Development and Exploration, Limited*)." Even "The Egyptian Delta Light Railways, Limited," does not escape our French critic's condemnation, because he considers that it has appropriated the rights of existing companies which were apparently not of British origin. Finally, he maintains that Government has by its issue of guaranteed

"Bons d'Irrigation" shown that "l'Egypte est appelée à devenir de plus en plus une exploitation anglaise."

Professor Brunhes occupies safer ground and exhibits less pique in elaborating his fourth and last cause of Britain's progress in Egypt, viz.: the important *rôle* played by Messrs. Thomas Cook and Son in completing "la conquête anglaise" of the Nile. Every one who has sailed up that river knows that the modern term "Cook" is, in the minds of the natives, synonymous with the ancient "Pharaoh"; and as Cook's steamers and tourists have converted the formerly quiet Nile into a crowded highway, the natives, who profit largely financially, have become greatly impressed with the evidences of British power and enterprise. Professor Brunhes, however, points out that the great Nile-king, Cook, has enabled Britain to win the Soudan by means of his flotilla of steamers, and he declares that, but for Cook, Khartum and Omdurman would probably have still been in the hands of the Dervishes.

Although Professor Brunhes pays Mr. Silva White, formerly Secretary of our Society, the compliment of recognising in his able work of 1899 on "The Expansion of Egypt," a luminous and correct forecast of the policy necessary to secure Britain's success in Egypt, he does not touch on some equally essential reasons for that success which Lord Cromer's recent report brings under our notice. For example, the finances of Egypt, once in a deplorable condition, are now flourishing, the accounts for 1900 showing a surplus of £E559,000, the revenue being the largest on record, notwithstanding the exceptionally low Nile. Again, the British administration is emancipating the fellaheen from the money-lenders, who have for so long preyed upon them, and is enabling them to secure advances upon reasonable and fixed terms. Again, all trafficking in slaves has, owing to British intervention, practically ceased. Once more, the Egyptian prejudice against women being educated has been removed, over 2000 girls being now educated in Government schools, some of whom are in training to become teachers.

Britain's success has not been confined to Egypt, it has extended to the Sudan. Sir Reginald Wingate's report shows that the British have restored peace and prosperity to that long distracted territory. But the fact that the Egyptians and Sudanese have come to regard the British as their friends and benefactors, a title which they have never before bestowed upon foreigners, forms, after all, the grandest feature in Britain's success in Egypt, and is referred to by Lord Cromer in the following noble words: "I trust that I am not mistaken in thinking that year by year the Egyptians themselves appreciate more and more fully the fact that every Englishman employed in Egypt owes his appointment solely to the consideration that his presence is conducive to their own welfare. On no single point, indeed, can there be any question of a divergence between British and Egyptian interests."

TRADE-ROUTES IN MANCHURIA.

By Rev. John Ross of Niuchwang.

The Chinese are essentially an agricultural people. Next to their passion for agriculture comes their craving for trade. There is among them as eager a desire to rapidly acquire wealth as there is on any stock exchange in Britain, and there is the same readiness in speculation to gamble for chances. The more restless and ambitious young men, who consider the duties connected with agriculture unattractively dull and unpromisingly slow as a source of wealth, betake themselves to commerce in one of its many forms.

China is in every direction intersected with roads and paths whereon there is an endless stream of commerce moving in all directions, leaving unvisited no hamlet, however small, which it touches with its wealth-acquiring finger. The extensive country called Manchuria is in all respects as much China as is Shanghai or Hankau. Barely a tithe of its people are pure Manchus, whose more easy life is so obscured as to be scarcely noticeable in the energy and industry of the antlike Chinese.

Every tiniest hamlet is vitally connected by the great routes of traffic to the financial centres of Manchuria, as every particle of the body is connected, through the great arteries, with the central motive powers —the heart and lungs. The veins and veinlets of traffic it is impossible and even undesirable to delineate; but it may be interesting to note the main arteries both by land and by water.

The port of Niuchwang, or Yingtsu as the Chinese call it, is the chief inlet for imports and outlet for exports into and out of Manchuria. From this a main road goes south-east through Kaichau, Hiungyao, Fuchau, Kinchau, skirting the coast to Port Arthur. There is a small port at and for each of the towns mentioned, where large numbers of immigrants land from Shantung. Indeed, the speech of that portion of Manchuria is entirely the dialect of Shantung. The traffic over this road has hitherto been inconsiderable, for the country is mountainous, and though every valley is cultivated, the amount of produce available for export is not large. Port Arthur has always been regarded as a place of considerable strategical importance. It was defended by the last Chinese dynasty against the Manchus years after Manchuria had been acquired by the latter. Therefore in recent years it was strongly fortified by French and German military engineers, who made it virtually impregnable from the sea. Indeed, the French navy, when scouring the Chinese coast, did not deem it prudent to attempt its reduction. Neither Chinese nor any other Power had conceived the possibility of Japan preparing an army, at the very time when the fortifications were being erected, which, approaching it in the rear, would attack and take it from the land side. This route will hereafter be infinitely more important, as it is the route of the Russian railway.

Another road east from Niuchwang goes through Tashikiao—the "Great Stone Bridge"—which is now a very important station on the

railway. Passing a little to the north of Kaichau it goes through the picturesque town of Siuyen and across the beautiful Yang river to Fenghwangcheng and Wiju in Korea. Since the opening of Korea by the Japanese to intercourse with the western world this road has lost most of its importance. Formerly, at a village called the "Korean Gate," south-east of Fenghwangcheng, there used to be a great fair to which Korean merchants resorted in great numbers with gold-dust, the hides of their great ox, and with their extremely tough paper which was used by the Chinese for "glazing" their windows. The Chinese merchants went there with sugar, silks, and other products of their land, and with the best produce of the Manchester mills to barter with the Koreans.

About twenty miles east of the port this road enters the mountain chains which begin there and terminate only on the western shore of the Pacific. At all seasons this is an interesting road. In the winter there is a good deal of deer-shooting, the scrub on the hill-sides being traversed by beaters who drive the deer to the path. It is specially pretty in the opening summer and at the falling of the leaf. For scores of miles along the road and to great distances north and south of it, the hills are dedicated to forests of young oak trees, on the leaves of which the silk-worm of the provinces feeds. The trees are kept young, as the leaf of the third year is large and succulent. Thereafter the trees are cut down to make room for younger growth. The careful sericulturist sees that there is a continuous supply of young trees for his precious worms. The cocoon produces a coarse silk which is woven into pongee and usually worn in its natural khaki-colour.

Though by a good deal of zigzagging the road is made to run mainly in the valleys, mountain ranges have sometimes to be crossed. These crossings or passes are so steep that the large wagon traffic, so characteristic of Manchuria, is virtually unknown, all the traffic being borne on the small travelling cart. There is now no market at the Korean Gate, and the glory of that road as a commercial one is departed. There is still a fair amount of local traffic.

Siuyen stands half way between Niuchwang and Fenghwangcheng, about sixty miles from each extremity. It is also distant sixty miles by a good road to the port of Takushan, at the mouth of the Yang river. A road from Takushan through Antunghien or Shaho, at the mouth of the Yalu, goes to Fenghwangcheng, a distance also of sixty miles; midway between Tashikiao and Siuyen a road strikes north to Haicheng through a crowded country.

A road from Fenghwangcheng to the north leads through a remarkably beautiful mountainous country to Laocheng or Hingking, the original seat of the Manchus. It follows and crosses the charming river Ngai, an affluent of the Yalu, into which it falls directly east of Fenghwangcheng. The road passes through important villages and market towns so populous as to surprise one in the depths of these closely packed mountain ranges. There are lovely nooks here and there, and every valley is cultivated and filled up with a busy population. Perhaps the most beautiful part of the route is the region of Saimachi or Saimaji, directly east of Liaoyang and situated near the river Taitsu, which passes Liao-

yang. This town was the active seat of an iron-producing industry a quarter of a century ago. The iron ore was rich, of excellent quality, and coal and coke were abundant. The iron was smelted by the rough but efficient methods of the Chinese. But though, on account of its superior quality, the iron sold for more in the open market than did European iron, the cost of production by the Chinese crude process was so great that the industry has been choked out of existence. More will be heard of this region—for the iron and coal are spread over a great area—when the country is opened to those who can work the abounding coal and iron with adequate capital and scientific means.

From Fenghwangcheng another historical route runs north-west to Liaoyang. On this road is the famous pass where the Koreans, when being driven out of Manchuria by the Chinese twelve centuries ago, defied the whole might of China for several years. The Japanese failed to push their way across the famous pass in their recent war against China.

Returning to Niuchwang we touch the great north-east trunk road which runs parallel with the course of the Liao river—the river like the mountain chains of the country running from north-east to south-west. Mentioning the course of the mountains reminds me that the few slight shocks of earthquake I have experienced in Manchuria came all from the north-west, at right angles to the trend of the mountains.

Fifteen miles east-north-east of Niuchwang is the village of Kaukan or "High View," where the road divides, one route continuing in the same direction to Haicheng, the other going north-east to Niuchwang proper. The two reunite a little to the south of Shaho, a prosperous market town, ten miles south of Liaoyang. The road by Niuchwang is shorter by a few miles, and is the main road in winter, when water, bog, and earth are solidified as iron by the keen and persistent frost. Foot travellers and riders may almost always find a path. But the summer road for carts is *viâ* Haicheng, where another road from Kaichau meets this one.

The road from Haicheng passes by therapeutic sulphur hot springs with a great reputation. It then goes to Anshanchan, or Saddle mountain, the most northerly point of the Japanese invasion, which was also anciently a famous Korean city. At this place a branch road runs east to the magnificent serrated ridges of the Chien Shan or "Thousand Peaks," among whose numerous sinuosities and valleys scores of Buddhist and Taoist monasteries find picturesque situations among their well-wooded surroundings.

The direct road from Anshanchan goes on to Shaho, Liaoyang, and Mukden. It passes through the flourishing city of Tieling, and, a couple of miles south of Kaiyuen, bifurcates. One branch goes north-east, and at Weiyuenpu passes through the border of Liaotung province into that of Girin. It skirts the west side of the great Imperial Forest, which has been lately opened up to cultivation. Over a beautiful, hilly country it goes through Yitungchau to Girin. No heavy wagons can go over this route; but light wagons and the common travelling cart prefer it, as it is shorter by a great deal than the other.

This other road passes from the point of division through Kaiyuen, and seven miles farther north goes through the frontier at Machientai Gate. Seven miles farther on is the large and flourishing *fu* city of Changtu. Beyond that gate and on to Kwanchengtsu the country is particularly rich and thickly populated. There are not a few large market towns, and the villages are so common that one is barely passed before another presents itself.

At Kwanchengtsu there is another bifurcation, one road leading east eighty miles to Girin. This is the heavy wagon road as it is virtually level. Another road goes north-east, crosses the Sungari, enters the prosperous town of Shwangchengpu, whither also comes the road from Girin. The shorter and direct road is available when the frosts of November bridge the Sungari. This road goes from Shwang north-east and north *viâ* Ashiho and many another city and town, across the Sungari on its eastern course, through Tsitsihar to the southern bank of the Amur, where Chinese jurisdiction comes to an end.

This entire route from Niuchwang to the Amur is in an extensive plain, the way being virtually level. The Chinese call the distance 3000 li or 1000 miles. A travelling cart occupies a month in traversing this route. This plain is remarkable not for its length only; it is in much of its extent exceedingly broad. It is formed throughout of the rich Chinese soil called *löss*, which is particularly fertile. The whole plain south of the Sungari is splendidly cultivated by a swarming, industrious, and prosperous peasantry.

In the province of Liaotung, sorghum or "tall millet" is the principal product and the chief sustenance of man and beast. Kwanchengtsu is the centre of a great area devoted to wheat. In that region wheat is probably cheaper than in any other part of the world. Barley is grown all over for distillation into whisky, of which more, I suppose, is distilled in Manchuria than in Great Britain. It is universally drunk, but no drunkenness is visible. Beans of many varieties are grown for export. They form the staple of trade. A yellow variety is specially rich in oil, which is expressed in great quantities by huge circular granite wheels rolling in a granite groove. It is used in cooking, for light, and for lubrication. The bean cake, made of the residue after the oil is expressed, is splendid feeding for horses, and sent by the scores of steamer loads to Canton and the south, to be used as manure for the fine cane sugar grown there.

The rich soil of the great province of Tsitsihar, or Heilungkiang as the Chinese call it, still lies asleep, waiting the waking touch of the Chinese plough and spade. It will form a wheat area of great extent and fertility. It, with the whole rich southern half of Siberia, can supply enormous quantities of wheat, and give employment to millions of people. The Russian railway will bring both to within easy access of northern China, where exists a great market for good and cheap flour, and a great surplusage of population.

Retracing our steps to that point south of Kaiyuen where the trunk road bifurcates, we find it to be the point of junction for another road, which is of comparatively recent origin, but on which, during winter,

there is a great and growing wagon traffic. It runs up the splendid valley of the Ching river which flows by Kaiyuen. The valley is one of the finest in Manchuria, wide, rich, and densely peopled with many a large village and market town. This road skirts the southern edge of the Hunting Forest, running east and north-east. There is a small pass at the head of the Ching river, over which, at a large town, the road enters the magnificent valley of Hailungcheng. Through this valley and city it stretches northwards, and, a short distance out from Girin, joins the road through Yitungchau.

The goods carried by this route are of the same character as by the road east from Mukden. The eastern valleys get less heat than the plains, so that the tall millet, which ripens late and runs risk of destruction from early hoar-frost, is replaced by Indian corn or maize, both white and yellow.

To the far east of Kaiyuen, at the city of Hailungcheng, there is a road leading south through well-forested mountains. After entering the hills the road bifurcates, one going to Tunghwa, the other to Sinpinpu, east of and close to Hingking, the ancient capital of the Manchus and the seat of their origin. Tunghwa is a hundred miles farther east.

The railway necessarily runs generally in the direction of this main road—a great main road, running eastwards from Mukden, *viâ* Hingking, Tunghwa, etc., to the bank of the Yalu on the Korean border, and then by bridle-path along the river, or in a steep hill-side, on to the Long White Mountains. For 250 miles east of Mukden this road is available for the heaviest traffic. But the very heavy traffic is always carried in winter when the rivers are frozen solid. There are numerous mountain passes over which heavy wagons cannot go in summer. Small travelling carts can always go, however.

Along this road are borne thousands of tons of hemp, of which excellent rope is made, and many hundreds of tons of tobacco which finds its way extensively along the seaboard of China. There is a valuable traffic also in indigo, which is, by the aid of lime, extracted in pits from a polygonaceous plant which delights in marshy soil. A great deal of opium grown in the eastern valleys also finds its way to market by this route.

From Liaoyang, along the south bank of the Taitsu, through an endless succession of villages in a country of luxuriant growth, a road goes to Saimaji, already referred to. Along the north bank of the river there is an extensive area where coal, soft and anthracite, is found together with rich iron ore. The Russians have sunk some pits scientifically in that region, east of the town and coal depôt, called Yentai. It is to be hoped these pits will do justice to the deposits there, and yield an abundant and cheap supply of fuel for the country, which has foolishly neglected its hidden treasures.

All the main roads above referred to lie to the east of the Liao river, and converge, for commercial purposes, ultimately at the port of Niuchwang.

Starting from Yingtsu, as the Chinese call the port which stands about twenty miles by river from the bar formed by the junction of the

noble river with the sea, there is a road crossing the Liao and traversing the nitre-laden soil along the sea, till at Shisanchan it falls into the great road from Peking to Mukden. At Shisanchan we come upon a highly cultivated and rich soil crowded with a busy and prosperous population. The road goes through the large and flourishing city of Kinchau, formerly written *Kingchow*, and other cities and large towns till it enters the triple city of Shanhaikwan, where the Great Wall ends. Northwards from Shisanchan the road, passing to the east of Kwangning and Yichau, goes to Sinmintun, a busy city of *fu* rank. Then it goes east, crossing the Liao, and ends at Mukden.

At Sinmintun a road goes northwards, passing out of the province of Liaotung by the Gateway of Fakumen, where a direct road from Mukden joins it. Crossing the Siramuren this road goes ever north till it unites with the trunk road from Kaiyuen to Kwanchengtsu. At Fakumen the crush of wagon traffic is so great in winter that there are policemen at the street crossings to guide the traffic as in the London streets.

At the junction of the Nonni with the Sungari, the accumulation of water looks like a lake. In the late autumn when the frosts set in, great numbers of fishermen drag in countless myriads of fish to the bank. They throw them on the frozen earth, and they become speedily solid masses of ice. In this condition they are put on to wagons, each wagon carrying from one to two tons. The wagons take them away south, mostly passing through Fakumen and going to Mukden, or into the province of Chihli as far as Peking, which is probably twenty days' journey from the fishing-ground. In Manchuria the fish may remain a mass of ice till the end of February or the beginning of March. There are great sturgeon, huge carp, and many another fresh-water fish. The finest is perhaps the beautiful "white" fish, more fat and more delicate than salmon, which, by the way, is not to be found in the waters of the Sungari, though it is plentiful in the Amur.

Besides the ferries across the Siramuren and the Liao in connection with the main roads, there are innumerable ferries for local convenience.

At the crossing from Fakumen on the Siramuren, a large port has arisen to considerable importance within recent years. It is fast becoming the most important depôt for the grain of the wide agricultural region spreading out in all directions from it. During the winter, when the earth is frozen into a stonelike solid mass, wagons in endless succession unload their precious burden of grain in the great storehouses at Tungkiangtsu, as this port is called. As soon as the great winds of March, impregnated with the warm breath of the south, kiss the ice away, junks innumerable run down river to the port of Yingtsu, bearing their cargoes of grain, and especially of beans, to be taken away in foreign steamers.

Tieling, which is but a short distance from the river, is a similar depôt for winter-stored grain, and has an extensive traffic with Niuchwang. It is to be one of the chief stations on the Russian railway. Another depôt on the river bank sends away the spare grain of Sinmintun. All the grain in the neighbourhood of the river is sent down in the flat-bottomed junks from any point convenient.

Mukden has great storehouses for grain in the city, which is shipped in the open season on similar but smaller boats. This used to be by far the most important centre for the storage of grain and for its financing. But both Tungkiang and Tieling store more grain now than does Mukden. The Mukden boats go down the Hwan river to a point west of Liaoyang, where the Taitsu falls into it. From Liaoyang there is a considerable traffic by the Taitsu.

For several years a good deal of grain has gone down the Yalu to the port at its mouth called Antunghien. This port is connected with the older one at Takushan.

Besides grain, there is borne on the rivers the enormous timber-trade of Manchuria. At one time Chinese travellers in Manchuria wrote of forests so extensive that they took thirty days to get through, and so dense that during all that period they could not see the sun. The utmost of which this density is true of primeval forest now is three days. Then all the valleys were crowded, and the mountain-sides covered with the foliage of pines, oaks, planes, walnuts, birch, and other trees. The rapid and great increase of the population has deforested thousands of square miles. The banks of all the great rivers and their affluents have for years been bared for a quarter of a century. But thousands of wood-cutters still lead a hard and not unromantic life in the forests, miles away from rivers, and the traveller can hear the echo of their axe-blows ringing off the mountain-sides on a journey of many days in succession. South, west, and north of the Changpaishan, the woodman is annually creeping nearer and nearer to the great central mountain of Manchuria.

Miles upon miles of rafts float down the Yalu and its great affluent, the Hwankiang, which flows by Tunghwa. Scores of great blocks of wood are lashed together to form one raft. A small tent of birch bark and straw matting erected on the raft affords shelter for the men, and in it they have their kitchen as well as their bed. They float down by rapids and on long stretches of the river, as smooth and as apparently motionless as a pond, passing scenery of all kinds, the grand, the beautiful, or the tame. They often take a couple of months getting down to Antunghien, where there is a custom-house, at which the small tax is exacted which the Chinese government receives from the wood. From this port, or from Takushan, the great piles and beams find their way to Chifu to supply part of northern Shantung; to Tientsin to supply that great city and neighbourhood; and to Yingtsu to supply the south of Manchuria with wood of many kinds and for all purposes.

The Taitsu bears down timber for Liaoyang and the Hwan from Sinpinpu, and Yungling for Mukden. The snow on the mountains in winter is utilised to sleigh the heavy timber to the nearest river which contains water enough to bear it away after the thaw of March clears the rivers of ice. On the Sungari great quantities of splendid wood goes north to and far beyond Girin.

The timber is of various kinds. The chief favourite for ordinary use is the pine "soft" and "hard," of which there are not a few varieties. Walnut, plane, and oak are common. Elm and maple are not

so general, and are used where toughness and durability are required, as in the axles of carts. The Chinese claim nine kinds of elm, and four or five kinds of oak. The wood which shows the most beautiful grain, and which is used for the finest cabinet-work, is called the "spiny walnut." The wood is certainly very beautiful. It is found growing on the rocky and precipitous sides of hills, and is often difficult of access. It costs three or four times the price of pine.

CAPTAIN DEASY AND THE ROOF OF THE WORLD.[1]

A REVIEW.

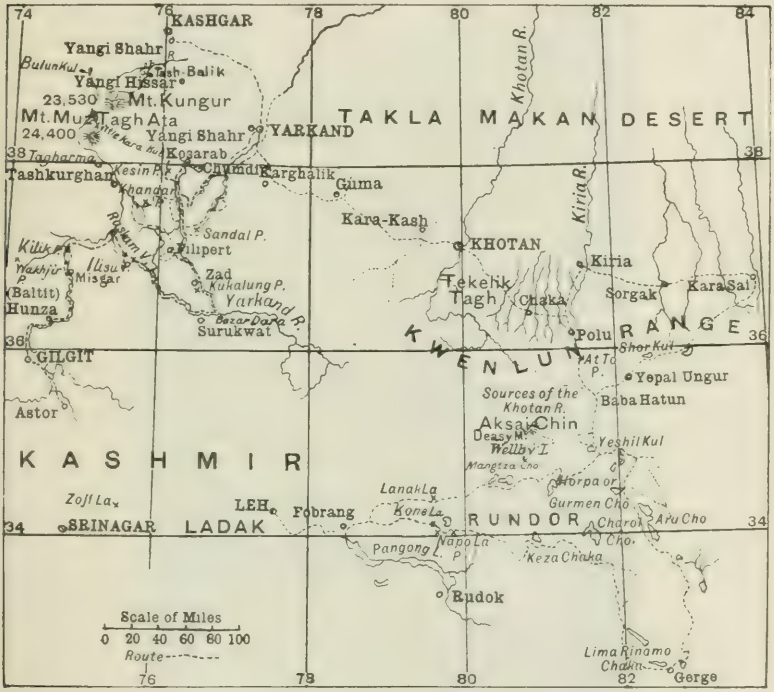
Captain Deasy's admirable account of his two expeditions on the Roof of the World may be divided into three parts, not serially according to the order in time, but regionally according to the main fields of his surveys. In the first of these he is occupied with Western Tibet (in the first six chapters); in the second with Sarikol and Raskam (in chapters vii., viii., ix., xiii., xiv., xv., xvi., and xvii.); in the third with the borderlands of Chinese Turkistan and Tibet (in chapters x., xi., xii., xviii., and xix.). To these may be added, by way of completing a preliminary survey, his account in the last two chapters (xx. and xxi.) of Chinese Turkistan.

Having long entertained the desire to travel in unknown lands, he availed himself of an opportunity in the spring of 1896 and resolved to proceed to Tibet, attracted thereto by a recently published map of that country on which a vast extent of territory was marked "unexplored." He set out from Srinagar on April 27, along with Mr. Arnold Pike, who accompanied him throughout this expedition, from Leh on May 25, and from Tankse on June 1. The pass by which he had decided to penetrate into Tibet was the Lanak La. From Fobrang, "a tiny village of about half a dozen houses, at an altitude of about 14,800 feet, probably the highest cultivated place in the world," there was a choice of two routes, one by the An La, which was not mapped, the other by the Marsemik La. He set out from Fobrang, after a final halt of some days, on June 9, and proceeding by the Marsemik La, he crossed the Lanak La (18,000 feet), on June 18, thereby passing from British to Chinese territory.

Beyond the pass (or La) it was practically unknown country but for one or two itineraries. Making it his aim to proceed past the Mangtza Cho to the north side of the Horpa Cho—the opposite side, that is, to the itinerary of Captain Bower—he succeeded there in locating and ascertaining the altitude of a double-peaked mountain, which was the highest peak in the course of his expedition; it is directly north of Horpa Cho (and Wellby lake), and on the south of the Aksai Chin;

[1] *In Tibet and Chinese Turkestan. Being the Record of Three Years' Exploration.* By Captain H. H. P. Deasy, late 16th Queen's Lancers, Gold Medallist of the Royal Geographical Society. With Appendices, Maps, and Illustrations. London: T. Fisher Unwin, 1901. Pp. xvi + 420. *Price* 21s.

its exact position is 35° 19′ 27″ N.L., and 80° 58′ 22″ E.L.; its height is 23,490 feet. In *La Géographie* (the bulletin of the Geographical Society of Paris) for May, M. F. Grenard proposes to designate it Deasy Mount or Peak. Thence Captain Deasy proceeded to the east end of the Yeshil Kul, to the east of which several numerous herds of antelopes were met with—some 15,000 is the estimated number seen, and subsequently Captain Bower's opinion was corroborated that antelopes are not met with below an altitude of 15,000 feet. Captain Deasy then went south, passing along the west side of the Aru Cho, and down the valley of the Damtang Lungpa, the most important river, and arrived at



Captain Deasy's Itineraries, 1896-99.

Gerge, the lowest point of the itinerary, 14,330 feet. To penetrate farther was recognised as impossible, on account of the hostility of the officials and natives, in accordance with positive orders from Lhasa. Nor was he allowed to leave Tibet by the route through Kangri, "where, at the annual fair held in the autumn, we might purchase sufficient supplies and transport to enable us to reach Almora." He therefore returned to Ladak by way of Rundor and the Nabo La, 18,800, or 18,880 feet, which was the highest point of the itinerary. About half way between Gerge and the Charol Cho, a fine head of an *Ovis Ammon* was found: it is said to be the largest known, being 57 inches long and 18¾ inches in circumference at the base of the horns. He arrived at Leh on

November 13, and at Srinagar on December 11, the caravan having travelled 776 miles through Tibet. "Tibetan habits," he says, "are in one respect curiously different from those of European mountaineers. In Scandinavia or in Switzerland the flocks and herds are driven from the hills to the valleys at the approach of winter, but in Western Tibet the sheep and goats are driven to the lofty ground, when the snow begins to cumber the valleys. The heights are constantly exposed to winds which sweep them clear of snow, so that they usually present some pasture available for the hardy flocks of the country. In these regions there seems to be no great snowfall; on the heights it is certainly slight. We could

Scene in the Tolde Kul Su Valley.

discover scarcely any trace of avalanches, and, though we sought to determine the snow-line, we could find very few data on which to generalise. No well-marked limit could be traced, but probably little snow lies all the year round in Western Tibet under 20,000 feet" (pp. 78, 79). This bald outline can give but a slight indication of the important work that Captain Deasy achieved by his surveys; of the severe hardships that he and his caravan endured; and of the formidable difficulties, human as well as physical, that beset his path.

On his second expedition Captain Deasy set out from Srinagar on September 15, 1897. It was his aim to survey that part of the valley of the Yarkand Darya from the west end of Raskam to the vicinity of

Yarkand. He had not been satisfied with the representation of the Yarkand river on Lord Curzon's map of the Pamirs which had been published in the *Geographical Journal* for July 1896. Much of it was represented by dotted lines, as only at Langar and Sanglash had it been crossed by Europeans. Nobody had followed it from the west end of Raskam. Proceeding by way of Bandipur, Astor, Gilgit, and Baltit, the capital of Hunza, he crossed the Kilik Pass (15,850 feet) on October 20, and pitched his first camp on the Pamirs, a little to the north, not far from the Kukturuk valley, at an altitude of 13,950 feet. There was little snow on the Kilik Pass, and none on the Taghdumbash Pamir.

Captain Deasy commenced his survey work on October 22 at the west end of the Taghdumbash Pamir, and then moved to Ujadbai and Mazar Sultan, where he halted for some days to make certain about his positions. It soon became evident that the natives of the district, Kirghiz and Tajiks, were unwilling to aid him in the direction of Raskam, in accordance with the secret orders of the Taotai of Kashghar, as he afterwards learned. After some big game shooting near the Kanjarab Pass (14,950 feet), and camping at Oprang with a view to the Oprang Pass to Raskam he decided, after receiving reports on the several passes, to choose the Ilisu Pass. Up to the Taghdumbash Pamir, Captain Deasy had been accompanied by Captain R. P. Cobbold, but at Oprang they finally separated for surveying and big game shooting respectively. The ascent to the Ilisu Pass (16,750 feet) was rocky and steep, but the descent was easy to the Yarkand Darya down the Talde Kol Su valley. "It was in this valley," he says, "that I first became acquainted with the distinctive features of the region. Bold, rugged mountains, absolutely barren, and, as a rule, so precipitous as to be within very few degrees of the vertical, towered above us on either side to a considerable height. The winter sun in many places could scarcely reach the bottom of the valley, and, when it did, it was only for a little while." As he could find no ground fitted for camping at the mouth of the Talde Kol Su, he ascended the Yarkand Darya or Raskam Darya, as it is there called, to Sarok Kamish. Thence the most convenient path in the desired direction to Yarkand led up to the Topa Dawan or Pass, but the Tajiks from the Taghdumbash Pamir refused to accompany him, and he found it necessary to ascend the Raskam Darya to Bazar Dara. "The tract known as Raskam is that portion of the Yarkand river stretching from Bazar Dara, a small fort at the mouth of the Dozak Dara Su, westwards to the point where the river turns sharply to the north. The uninhabited valley is bounded by steep and lofty mountains, utterly barren, and, with the exception of the Miskan Jilga, a small valley to the north of the Topa Dawan, where there is a little cultivation, and a few spots of which Azgar and Kuktash are the more important, the whole valley is unfit for cultivation. A few hundred yards east of Azgar the valley is very narrow, but opens out a little near Surukwat or Karaul, where there are small trees and a patch of good short grass. This spot, situated in a semicircular depression between the river and a series of cliffs almost all vertical, forms a convenient camping-ground. A short distance beyond, the valley again resumes its gorgelike aspect. By far the widest portion of Raskam is at Chiung

Jangal (Large Jungle), where the bottom of the valley contains low dense jungle, but little grass" (pp. 119, 120). Between Surukwat and Bazar Dara (11,850 feet), the march, though only about ten miles, took a long time, owing to the necessity of fording the river repeatedly. The Chinese garrison at Bazar Dara consists nominally of twenty Kirghiz, and is within the district of the Beg of Zad. The Dozok Dara (Difficult

Sarikol and Raskam.

Valley), up which he now proceeded, is stony and barren. The pass at its head, the Kukalung Pass, is 15,500 feet (15,850 feet on the map); Tapin Chat is 14,300 feet. At Zad (12,600 feet), the largest permanent encampment of Kirghiz in the Kulan Urgi valley, there was a halt of some days, one of which was Christmas Day. Survey work had to contend with formidable difficulties even to the hardy and sure-footed yaks. As the season of heavy snowfalls was imminent, it was necessary to proceed as soon as possible to the plains of Turkistan. His route now

was along the bottom of Kulan Urgi valley down to Tir, the largest village in the valley, about five miles from the junction with the Yarkand. "Mountains utterly barren and too precipitous to be climbed, except at one place near Yagzi, rose to a great height on either side. At some places the river was frozen over, and one could cross on the ice, but between Issok Bulok Agzi and Yagzi (8600 feet) the current was so rapid that the stream was only partially bridged in this fashion. From a point a little above Yagzi down to the Yarkand river, there are numerous patches of cultivation with apricot-trees scattered about. In fact, wherever cultivation is possible it is carried on" (pp. 125, 126). From Tir there was a choice of two passes, the Karamut Dawan and the Sandal Dawan. He chose the latter in accordance with the advice of the headman, the Yuz Bashi (Head of a Hundred Men), of Tir, but on

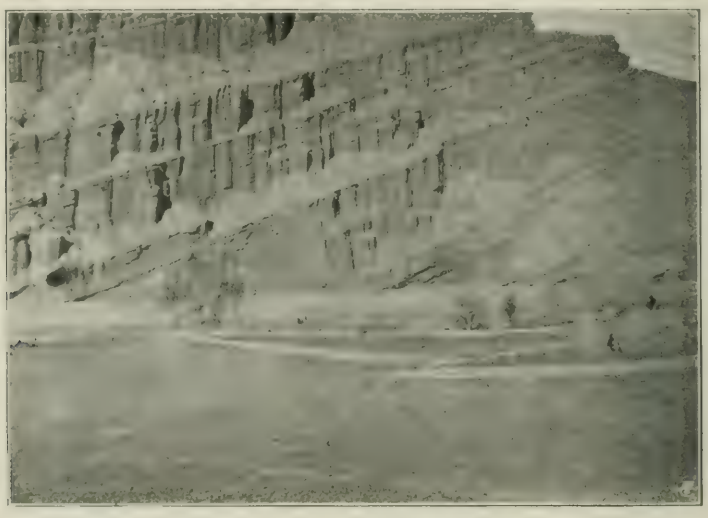
General View of the Asgan Sal Valley.

reaching the Asgan Sal valley he learned that he had been misled into taking the longer and more difficult route. Tir is 7200 feet: the Sandal Dawan, 16,000 feet (15,800 feet on the map); and the Karamut Dawan, 15,200 feet. This was the first habitable country since leaving Hunza. "From Zumchi to Yarkand the whole country (with exception of but a few miles) is cultivated and fairly populous, but the breadth of the cultivated area is restricted by the necessity for irrigation. When this fails, the country is a desert of loess, with sand here and there. The loess evidently reaches to a great depth, and at Tar Agzi its stratified formation, seen from a distance, resembles rocks. In contrast with the mournful wastes on either side, the Asgan Sal valley, with its cultivated land and its fruit trees, mostly apricots—and at Oyung, pears too—seems a paradise" (p. 129). On January 20, 1898, he arrived at Yarkand.

There Captain Deasy remained for about three weeks. He then left

on February 8 to explore the unknown parts of Sarikol. He desired to ascend the Yarkand valley from Kosarab to the west end of Raskam. But he found the river without ice, and had to change his plan. He therefore proceeded across the Arpa Talak Pass (12,400 feet) to Langar, where the ice was still strong enough to bear the caravan, and reached the foot of the Khandar Pass; but the natives refused to accompany him farther as snow had begun to fall heavily. He returned to Langar on February 19, and after another attempt to ascend the valley of the Yarkand from Kosarab, where coal, iron, and copper are found but little worked, he returned on March 1 to Yarkand.

It was Captain Deasy's original intention to complete his survey of the unknown parts of the Upper Yarkand basin and then proceed eastwards into Tibet. But as this purpose was still unfulfilled, he resolved



Peculiar Geological Formation, at Tar Agzi, in the Asgan Sal Valley.

to spend the summer in Tibet and resume his work up the Yarkand Darya when it would be frozen in the following winter. After a fortnight's rest in Yarkand on his return from the borderlands of Turkistan and Tibet, he set out on November 3, and finally decided to go by Takla, the Arpatalak Dawan, Langar, and the Khandar Dawan, to the upper part of the valley which is known as Wacha among the Tajiks but is called Uchi by those who speak Turki. When he arrived at Langar on November 8, he found to his great surprise that the river was quite free from ice. There was a ford above the village, but it was so deep that all the animals had to swim across. The Beg of Sarikol, however, who spends part of the year at Tashkurghan and the remainder at Tung or Tang, a few miles from the left bank of the Yarkand, opposite Langar, kindly supplied some camels, by which the transit of the baggage was effected. The upper part of the ascent to the Khandar

Dawan was very steep and stony, but the descent was easy into the Wacha valley. There he succeeded in making some important observations of the Muz Tagh Ata about sixty miles distant, for which purpose the bases at the camp formed an equilateral triangle with sides about six miles long.

From that valley he crossed the Thong or Thongal Pass, 14,000 feet (14,200 feet on the map) to the Mariong valley. As Captain Deasy was the first European to set foot in it, he has settled for good all doubts regarding its character and designation. On many maps it is called the Mariom (or Marian or Maryang) Pamir (cf. Lord Curzon's *The Pamirs*, p. 21). Its correct name, according to Captain Deasy, is Mariong, and its physical characteristics are not those of a Pamir which connotes a pastoral tract in a wide-bottomed valley. The Mariong valley is narrow, and is

Looking down the Valley of the Yarkand Darya from the mouth of the Misgan Jilga.

inhabited and cultivated wherever possible. The Mariong village consisted of a few houses at the mouth of a narrow valley leading from the Thong Pass; the largest village is Nosh Tung, in and about which there was a fine sprinkling of apricot-trees. This valley was descended to its junction with the Yarkand at its most westerly bend, but all progress up this latter valley was soon rendered impossible by a gorge which the deep river filled between vertical rocks. The Mariong valley was again visited, and a route to the Yarkand was discovered by way of the Sargon Pass, 11,500 feet, Pichanyart, the Shamatogal Pass, 12,500 feet, and the Tugadir Pass to Sanglash at the mouth of the Pil valley. This village, consisting of three houses and a water-mill, stood about three-quarters of a mile from the Yarkand river and close to the mouth of a side-valley. There was some little cultivation in the vicinity, but no traces of jade, or of petroleum, nor were the inhabitants acquainted with them, though the

region has been credited with both. Grombchevski had visited Sanglash from Tashkurghan by way of Pichanyart and the Tugadir Pass; without going farther east he had returned by the same route. Captain Deasy then passed up the Pil valley to Pilipert, and next across the Mamakul Pass, 16,550 feet, into the Misgan Jilga or valley. When he arrived at the Yarkand he had attained the goal of his desire. "To determine the thickness of the ice on the Yarkand river, which, under the high vertical bank close to the mouth of the Misgan Jilga, was nearly frozen across, I made two holes in the ice. The first, about 20 feet from the bank, showed ice 20 inches thick; the second, in mid-stream, showed ice about 6 inches thick, but covered with frozen snow about 6 inches in depth" (pp. 252, 253). Having achieved his aim of visiting the west end of Raskam, he returned to Pilipert, and thence proceeded to the Kulan Urgi valley, where he spent Christmas Day, 1898, at Zad. "The Kulan Urgi valley below Issok Bulok Agzi contains few Kirghiz, and, according to all accounts, the valley down to that encampment is, during summer, forsaken by nearly all its inhabitants. When the warm weather and the long days set in, the people migrate with all their herds to the pastures in the neighbourhood of the Yarkand-Leh trade-route. There the yaks are hired by the Indian traders for the transport of goods along the difficult portions of the route; the Kirghiz are paid mostly in kind, and when the season for traffic ends, they return to their valley with supplies for the winter." There remained some odds and ends to complete his surveys. From Zad he moved to Tir, about five miles from the junction of the Kulan Urgi and Yarkand rivers, on December 29, and spent several days there or in the vicinity, making excursions to the Karamut or Kuramut Pass, 14,400 feet (15,200 feet on the map), to the Sandal Pass, and up the Yarkand Darya to a point almost within sight of Sanglash. On January 10 he arrived at Langar for the fourth time, and proceeded to Kosarab by way of the Danga Bash (or Tashkurghan river, as it is there called in its lower course, the volume of which seemed equal to quite one-third of that of the Yarkand above the confluence), Beldir, Shoti (10,000 feet), the Kesin Pass (12,900 feet), and Bagh. From Kosarab he ascended the Yarkand Darya in order to complete his survey by linking it on to his work from the south side of the Tashkurghan river. "The extent," he says, "of the village of Kosarab surprised me in view of the poverty of its surroundings. The whole neighbourhood being very bare, with few signs of cultivation, such prosperity as the locality enjoys is probably due to the gold-washings carried on in summer on the banks of the river. In the neighbouring mountains coal, copper, and iron are found, but the natives have little energy or enterprise, and the minerals remain unworked. As to the amount of gold annually obtained on this stretch of the river I had no time to make inquiry; but undoubtedly gold is found in some small quantity, and is dealt in at the village at the rate of $26\frac{1}{4}$ of silver to 1 of gold. A more important question is that which relates to the region whence the gold is borne down by the stream. This problem awaits solution by other travellers" (p. 279). There the Yarkand Darya is best known as the Zarafshan ("full of gold"), and the gold is chiefly

found along its banks between Kosarab and Ara Tash. The Yarkand Darya is known to the Chinese as the Jade river, and to others as the Raskam Darya, and Chiung Darya ("big river"). It is only in the depth of winter, as Captain Deasy found, and then only for about six weeks from the beginning of the year, that it is possible to take animals along the valley of the Yarkand river, from near the west end of Raskam to the mouth of the Danga Bash or Tashkurghan river, and only in an exceptionally severe winter can they proceed direct to Kosarab. When he arrived at Chumdi he ascended the Asgan Sal valley to complete his survey and do some topographic work. Then, following the right bank to the Yarkand, he worked down to the point where the river is crossed by the road to Khotan, and thus completed the survey of the stretch from Bazar Dara, a length of about 300 miles, of which at least that portion between the west end of Raskam and Kosarab had never before been surveyed. On February 2 he was once more at Yarkand after a three months' tramp of more than 1000 miles.

At several points since the day of his coming to the Taghdumbash Pamir he had been able to observe the Muz Tagh Ata. From a station near Mazar Sultan he had obtained 24,380 feet for its height, and in the Wacha valley 24,402 and 24,403 feet. From these observations the Superintendent of the Trigonometrical Survey of India has accepted 24,400 feet as the height of the Muz Tagh Ata. It is therefore the highest summit north of the Himalayas. But there was a problem regarding it to be solved. Is it visible from Kashghar? He set out on February 10 by way of the Khan Arik route, and made his observations from a base six miles long. On Curzon's map of the Pamirs there is represented a peak bearing the name of Mount Kungur. He found its height to be, not 25,350 feet, but only 23,530 feet, and its position nearer Kashghar. The position of Muz Tagh Ata on Curzon's map is also incorrect, as it is really about twelve miles to the south-west and almost in line with Kashghar and Mount Kungur, so that it cannot possibly be seen from Kashghar or any point near that town.

On March 9 Captain Deasy left Kashghar, returning by the main route through Yangi Hissar, and reached Yarkand on March 14. At length, on April 25, he set out from Yarkand homeward bound, reaching Khotan on May 10, Polu on May 30, and proceeding to Ladak by way of the Lanak La, which he crossed on July 10, he arrived at Leh on July 21. On reaching Srinagar he estimated that he had covered more than 5300 miles. In the preceding summer and autumn Captain Deasy had performed some important work on the borderland of Turkistan and Tibet. After a visit to the Takla Makan desert, during which he exposed the systematic fabrication at Khotan of antique manuscripts, he left Yarkand on April 12, and proceeded to Polu by way of Guma, Khotan, and Chaka, intending to go direct to Aksai Chin and Northern Tibet. Official opposition, however, made it necessary for him to make a long circuit by Kiria and Kara Sai. He then passed up the Tolan Khoja valley, the upper part of which is known as Sarok Tuz, and crossed the Atish Pass, 16,500 feet, which was very easy and compara-

tively low, and may be considered the natural boundary between Turkistan and the tableland of Tibet. He then visited the sources of the Kiria and the Khotan rivers, and finally reached the east end of Yeshil Kul, where he succeeded in establishing a trigonometrical and topographical connection with the survey in 1896.

Besides the account of Chinese Turkistan in the last two chapters (xx. and xxi.), there are several appendices, which give in a tabulated form the scientific results of both expeditions, and a short glossary. In the botanical collection there is, says Mr. E. G. Baker of the British Museum, "a very interesting find, of possibly far-reaching significance." This is a plant determined by Dr. A. B. Rendle of the British Museum to be *Zostera marina*, Linn., which was found near Yepal Ungur, Aksai Chin, at an altitude of 16,500 feet. Close by his camp, which was at an altitude of 16,400 feet, but a little higher up, Captain Deasy noticed a dry water-course, the side of which presented a peculiar appearance. "On a closer examination," he says, "I observed a deep stratum of dry water-plants, similar in appearance to those that grow on the small lake immediately to the west of Horpa or Gurmen Cho. The extent of the deposit I could not definitely ascertain, but its depth was certainly twelve feet, probably more. Interspersed among the mud were many thin layers of blue shaly clay. In times perhaps not very remote a great lake must have extended from this spot eastwards for many miles, northwards to the Kwen Lun, and south-west to near Aksu, and possibly as far as the pass near Togral Monpo. The water, probably by erosion, had found a passage for itself through the Kwen Lun barrier and had gone to swell the Kiria river, until the bed of the lake ran dry" (pp. 183-85). Regarding this discovery Dr. Rendle says, "The dry water-plants referred to consist of dusty masses of short broken lengths of the grasslike leaves of *Zostera marina*, Linn., the Grasswrack. Its identity is put beyond question by the presence of a few fossils still protected by the spathe. The Grasswrack is a marine flowering plant, widely distributed on temperate coasts; its slender, ribbonlike, bright green leaves are a common object on our shores. Captain Deasy's discovery of remains of this plant at these high altitudes is of much interest. There is no record of its occurrence in Central Asia. It occurs in the Mediterranean, the Black Sea, and on the north-east coast of Asia, while a smaller species, *Zostera nana*, is found in the Caspian Sea." The presence of these and some other maritime plants occurring at high altitudes in Central Asia, such as *Glaux maritima*, Linn., and *Triglochin maritimum*, Linn., both of which occur in Captain Deasy's list, may be explained, says Dr. Rendle, by a former connection with the Mediterranean basin, indicated by the band of tertiary marine deposits stretching eastwards from the Alps to the Himalayas, and occurring at Leh at a height of 21,000 feet (p. 184).

In this account of Captain Deasy's book it has been deemed best to give some precise details of his itineraries and surveys. The great importance of his work consists in its many accurate details. It must not be supposed, however, that the baldness of this account is at all representative of Captain Deasy's style. He made it his chief aim, if not his sole aim, to survey these unknown parts beyond the British borders,

and his whole book is a record of hard work. His racy narrative shows by what patience, persistency and prudence he well achieved his aim amid all the formidable difficulties in his way. It demanded no ordinary courage and fortitude to keep on scaling heights and passes when the temperature was such that the ink froze between pen and paper as he recorded his observations. It becomes fascinating to follow him from camp to camp, up hill and down dale, as the unknown parts (with an old map for reference) assume definite shape in the mind according to his accurate determination of position and height. It is not surprising that the Beg of Sarikol, who was not unfriendly, had his doubts regarding Captain Deasy's motives, and that he remained unsatisfied, still sceptical, although Captain Deasy mentioned the Royal Geographical Society, spoke of the great interest manifested by all civilised nations in the rivers, mountains and general geography of other countries, explained that many British people were ready to devote their private means to assist in mapping unknown lands, and dilated at some length on the love of travel, sport and adventure which are common amongst the people of the British Islands. It was not for sport or the "fun of the thing" that Captain Deasy set out on his high enterprise to the Roof of the World, or had set about preparing himself to achieve it. Remembering Sir Richard Burton's warning that travel in unknown lands is mere waste of time unless the traveller has suitable instruments and skill to use them, he had sought to acquire the requisite knowledge. By study and practical work he had been fitting himself to undertake original and scientific work as an explorer. In 1893, when home on sick leave from India, he had begun the study of astronomy and surveying under the guidance of Mr. Coles of the Royal Geographical Society. On several voyages to and from India he had availed himself of the opportunities kindly afforded him by the officers of the P. and O. Company to practise regularly the taking of sights at sea. And he had devoted some time to these studies under Colonel St. G. C. Gore, R.E., at the Trigonometrical Branch of the Survey of India at Dehra Dun. It is gratifying, therefore, to know that the Royal Geographical Society has fittingly recognised him as a knight-errant in the most exacting service of Science. S. H. F. C.

[Note.—In this review by Mr. Capenny, in the paper by Major Medley, and in the note on the Chatir-kul by Mr. Taylor, there occur several names for passes in Central Asia. It will suffice to note that a distinction is made between three different kinds of passes, the natives of Central Asia giving the name of *bel* (or *bol*) to an easy pass; of *art* to a rocky defile; and of *dawan* or *davan* to a pass over a high chain.—Ed.]

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in May.

Captain H. H. P. Deasy, late of the 16th Lancers, delivered a lecture in Edinburgh on the 9th on the subject of his Central Asian travels. Sir John Murray, K.C.B., President of the Society, occupied the chair.

Meeting of Council.

At a Meeting of Council held on the 27th, the following letter, addressed to the President of the Society by General Sir Dighton Probyn, V.C., etc., Keeper of His Majesty's Privy Purse, was read :—

Privy Purse Office,
Buckingham Palace, S.W.,
20th May, 1901.

Sir,

I have the honour to inform you that I have submitted to the King your letter of the 16th instant, and in reply I am commanded to say that His Majesty is pleased to accede to the request contained in it to grant his patronage to the Royal Scottish Geographical Society.

I am,

Sir,

Your obedient servant,

D. M. Probyn, General,

Keeper of His Majesty's Privy Purse.

At the same meeting Mr. Lawrence Pullar was elected a life-member of the Society.

Meeting arranged for June.

A special meeting will be held in the Queen Street Hall on Monday 3rd June at 8 p.m., when Sir Godfrey Lagden, K.C.M.G., Resident Commissioner in Basutoland, will address the Society on "Basutoland and the Basutos."

Annual Closing of the Society's Rooms.

The Society's Rooms will be closed for cleaning during the month of August.

GEOGRAPHICAL NOTES.

EUROPE.

The Conference of Delegates from British Geographical Societies.—We are indebted to Dr. H. R. Mill for the following report :—

The Third Annual Conference of Geographical Societies was held on May 21st, in the rooms of the Royal Geographical Society. The following delegates were present—

Royal Geographical Society—
Sir Clements Markham, *President.*
Dr. J. Scott Keltie, *Secretary.*

Royal Scottish Geographical Society—
Dr. H. R. Mill.
Tyneside Geographical Society—
The Duke of Northumberland, *President.*
Mr. Shaw, *Secretary.*
Liverpool Geographical Society—
Captain Dubois-Phillipps, *Secretary.*
Southampton Geographical Society—
Colonel D. A. Johnston, R.E.

Sir Clements Markham occupied the Chair, and Dr. Keltie acted as Secretary.

The Minutes of the last Conference were read and approved.

A letter from the Secretary of the Manchester Geographical Society was read, saying that that Society did not propose to send a delegate this year.

A proposal from the Royal Scottish Geographical Society was communicated to the effect that a Conference should not be held annually, but only when important questions were presented for discussion. After several members of the Conference had expressed their approval of the suggestion, it was adopted with the understanding that when a Conference was desired it should be held in London on the day following the anniversary meeting of the Royal Geographical Society, but that such a meeting might, if desirable, be adjourned to any subsequent date.

Captain Dubois-Phillipps presented, on behalf of the Liverpool Geographical Society, a paper on the best methods of instruction in commercial geography. It was resolved that this paper should be printed, and sent for consideration to all the societies represented, with a view to full discussion at a future Conference.

A vote of thanks to Sir Clements Markham for presiding terminated the proceedings.

Marseille, the second city of France.—Marseille, and not Lyon, is now the second city of France according to population. Marseille has now 494,769 inhabitants, whilst Lyon has no more than 453,245. In 1896 Lyon had 466,028, and Marseille 447,314. The population of Marseille has therefore increased by 47,425, and that of Lyon has decreased by 12,783.—*Revue Scientifique*, 11th *May* 1901.

Calais and Amiens.—In order to shorten the railway journey between London and Paris it is suggested by the local representative of the British railways at Calais that the Nord Railway Company may see its way to opening a new line from Calais to Amiens, by Lumbres and St. Pol, thereby avoiding the considerable detour by Boulogne and Abbeville.—*Consular Report*, April 1901, No. 2582, Annual Series.

Canal between the Caspian and the Black Sea.—A scheme for a canal to connect the Caspian with the Black Sea recently came before the Russian Hydrotechnic Congress. With the continual increase in the production of iron, coal, and petroleum, the industrial centre of Russia is gradually moving to the south. At the present time about 600,000,000 poods (or about 9,680,000 tons) of coal, and about 400,000,000 poods (or about 6,451,000 tons of petroleum are produced in Southern Russia. At the same time the metallurgical industries and the trade in Central Asiatic cotton are also increasing. As the railways are unable to cope with this increasing traffic, it is proposed to construct a canal, which is to connect Astrakhan with Taganrog on the Sea of Azov. It is designed to have a depth of 22 feet and

a breadth of 25 fathoms, and is estimated to cost about 40,000,000 roubles (or about £1,445,000). Besides affording a convenient route for trade between towns on the Black Sea and the Caspian, it will be so constructed as to be available for irrigation purposes in the agriculture of South-East Russia.—*Handels Museum* of 21st March, cited in the *Board of Trade Journal* for the 4th April.

Russian Remounts in Poland. The discussion of the remount question in Great Britain, and the work of the Commission thereon, give special interest to the methods of Russia in Poland. The Consul-General, in his Report on Poland for 1900, says that up to the present horses for the Russian cavalry have been bought by remount officers, but from August 1901 they are to be bought by remount commissioners in the different military districts. These commissioners are every year to visit each of the stud farms in their districts, where they are allowed to give advances to owners of likely horses to the extent of half the normal price, which is fixed at £33, 10s. for the period 1901-3, the horses to be handed over in six months, or a year after the advance is given. All horses will be paid for by cheque on the nearest Treasury, except in certain special cases provided for in the regulations, when they may be paid for in cash. The following are the normal prices to be paid in 1901-3. The horses are divided into four classes: the first, "with breeding"; the second, "with breeding but with defects"; the third, "underbred"; the fourth, "underbred and with defects." For horses over 15·1¼ hands the prices are £45, £37, 10s., £32, 10s., £22, 10s. respectively. For horses from 14·3½ to 15·1¼ hands, £40, £32, 10s., £27, 10s., £20. From 14·2½ to 14·3½ hands, £35, £27, 10s., £20, £15. But for especially good horses of the first and the second classes over 14 hands 3½ inches, the Commission is allowed to pay £5 extra, provided the total amount paid by them for all the horses does not exceed the average laid down. Horses bought in the autumn must not be less than three and a half or more than five years, and no horse is to be bought under 14 hands 2½ inches, or over 16 hands 2½ inches. Horses may be of any colour except piebald. Only geldings and mares are to be bought, unless a stallion be something very out of the way. Mares in foal are not to be bought at all. In 1901 there will be shows of locally bred horses at Kalisz, Warsaw, Lomza, Minsk, Plavno, and Radom, in March, June, August, and September.—*Foreign Office Report*, Annual Series, No. 2578.

ASIA.

The Pamirs.—In the *Annales de Géographie* for 15th March 1901 there is a concise and lucid discussion of the Pamirs by M. G. Saint-Yves. It is now recognised, he says, that the word *pamir* is only a geographical term, the native use of which is like the use of the word *causse* in Central France. There are several pamirs, as there are several causses. He considers that the Khargosh Pamir, that is, the basin of the Great Kara Kul, should be separated from the Pamirs as a region, and assigned to that of the Transalai, to which it belongs from the point of view of physical geography. From the point of view of administration the Russians consider the military district of the Pamirs to comprise all the territory between the Transalai—say the Kizil Art—on the north, the Panj on the west and the south, and the Chinese frontier on the east. The command of this vast territory has been committed to a captain of the general staff, who is assisted by seven officers, with two hundred soldiers, infantry and Cossacks. The commandant resides alternately at Fort Murghab or Murghab on the Ak-Su, and at Kharokh near the Panj. Seven posts are occupied in a permanent way: Fort Murghab and Rang Kul on the Rang Kul Pamir; Istik in the Nicolas II. chain;

Langar near Kala-i-Panj in Wakhan ; Ishkashim, Kharokh, and Kala-i-Wamar, all on the Panj. If the basin of the Great Kara Kul, however, is separated from the Pamirs, their northern limit will be the chain between the Great Kara Kul and the Murghab—say the Ak Baital Pass. When thus reduced the military district is divided into two distinct regions, the Pamirs proper and the pre-pamirian valleys. The distinctive traits of the Pamirs are, first, their altitude, which gives them the aspect of plateaux, maintaining a height of 3500 to 4200 metres above sea-level ; second, the low relative height of the lateral chains ; third, the absence of glaciers and small amount of permanent snow ; fourth, the temperature, which is characterised by extraordinary differences in the same day and between spring and winter ; and fifth, the total absence of arborescent vegetation and the reduction of herbaceous vegetal forms to a hundred species. Two traits particularly distinguish the Pamirs from all other elevated table-lands : first, the presence of a great number of shallow lakes ; second, the nature of the rivers, the current of which is often hardly perceptible. The pre-pamirian valleys, on the other hand, have the aspect of deeply eroded valleys between bordering chains. The same opposition is to be seen in the repartition of the population : on the Pamirs, the Kirghiz of Turki race ; in the pre-pamirian valleys Tajiks of Iranic race in Wakhan, Shughnan, and Roshan. The Kirghiz of the Pamirs are sporadic, the Turki invasion having never followed this route from east to west. On the other hand, the Tajiks represent the advance guard of the Iranic race.—*Annales de Géographie*, 15th March 1901, pp. 156-164.

Chinese Turkistan.—The province of Chinese Turkistan is officially called Sin-Chiang (or the New Dominion) ; but this name, says Captain Deasy, is practically unknown among the inhabitants, who are content to describe themselves as natives of the several districts Yarkand, Khotan, etc. At the head of the administration is the Futai, or Governor, who is always a Chinese and resides at Urumtsi. Next to him come two Taotais, one of whom resides at Kulja and the other at Kashghar ; and next to these come the Chow-kuans (by Europeans commonly called Ambans), who may be regarded as district magistrates. The Taotais and Chow-kuans are Chinese ; but most officials of lower rank are usually natives. The principal of these are the Begs, and (in towns only) the Aksakals or heads of trades, who are Muhammadans, wearing Chinese dress and false pig-tails. Then come the Ming Bashis (or heads of thousands), the Yuz Bashis (or heads of hundreds), and the Oan Bashis (or heads of tens). The Bashis are men in humble position, who, not being required to make any compromise with Chinese usages, wear neither Chinese dress nor pig-tails. The governmental system is rotten to the core, and every official lives by systematic fraud. It is a poor province, and is regarded as a sort of Chinese Siberia ; towards the cost of its administration other provinces of China contribute annually about 200,000 taels. Islam is the only form of religion among the natives. Slavery was abolished in 1897, more than 2000 slaves having been liberated during 1893-97 through the good offices of the British Agent at Kashghar. Indian trade has to contend with great difficulties. The nearest railway station is at Rawal Pindi, whence the transport to Yarkand occupies about two months. From Leh to Yarkand the cost of carriage is about 40 rupees for 240 lbs., and the route is practicable for caravans during not more than about five months in the year. The profits are small (about 10 per cent.), and traders usually make but one venture in two years. The military force of China in Sin-Chiang consists nominally of 3000 cavalry and 4500 infantry ; but the actual strength does not exceed 960 cavalry and 1350 infantry ; it is distributed among the ten military districts into which the province is divided, about one-third of the cavalry and more than half

the infantry being stationed at Yangi Shahr in the neighbourhood of Kashghar. The province is absolutely at the mercy of Russia, but the methods by which Russia is working are diplomatic not military. In 1897 Russia applied to the Chinese for permission to occupy the large grazing ground known as Muluksha, lying on the north side of the Karakoram Pass on the trade-route from Yarkand to Leh, to be used as a place where Russian caravans could rest, although it is out of the way of Russian trade caravans. When the Mir of Hunza, on behalf of the Kanjuts, made application to the Chinese for permission to cultivate Raskam, the Russian Consul-General asserted that the Kanjut application was instigated by the Indian Government for the purpose of obtaining possession of Raskam, and that, if it were granted, Russia would demand Tagharma. Sooner or later, however, says Captain Deasy, the whole province of Sin-Chiang will fall under the sway of Russia; a Russian occupation of the province need not, *so far as commerce is concerned*, appreciably affect the interests of Great Britain; while no sane man acquainted with Sin-Chiang would advise the Government of India to saddle itself with its administration.—Captain Deasy's *In Tibet and Chinese Turkestan*, pp. 328-364.

Chatir-kul is a lake lying in the province of Semirechensk, fifty miles from the village of At-Bash and eighty-six from the Chinese town of Kashghar. It was surveyed in 1867 by a Russian officer; and again in 1897 a more thorough survey was made by the military topographic department of Omsk. During the interval little change seems to have taken place. The small detached lakes on the southern bank are now connected by a channel and are almost joined to the main lake, while by the receding of the shore small islands have been formed at the eastern end and a small promontory at the western. The basin has a length of 14½ miles, with a maximum breadth of 7¼, and has an area of 75 square miles. Its periphery measures 63 miles, and the surface of the water lies 11,438 feet above sea-level. The Chatir-kul has no outlet, and of the numerous streams which feed it only the Kok-aigir, the most important, which enters at the north-eastern extremity, and three or four on the southern and south-western shores carry water all the year round. The shores of the lake are low and everywhere accessible; they are quite barren, and no reeds or any other lacustrine vegetation grow along them. The bottom of the lake is muddy, and at a distance of 70 to 100 feet from the bank some water-weeds are visible on the bottom. The lake contains no fish, but is frequented by geese and ducks of different varieties. The depth of the water, in the absence of material for a raft, could not be sounded by the surveyors, but the commandant of the At-Bash detachment, crossing the eastern end in winter over the ice, found depths of 10½ feet, inclusive of the ice itself, 2 feet 11 inches in thickness. In the middle the lake is probably much deeper. The Kirghiz state that the lake begins to freeze over about December 20, and that the ice bears up to about March 20. According to the same authority the water has been rising during the past seven years. On the north and south lofty mountains hem in the lake, rising above the snow-line to heights of 13,000 to 16,000 feet above sea-level. On the west there is a small rise in the ground, and on the east a level stretch of country separates the basin of the lake from the valley of the Ak-sai. The caravan route from the Narin fortress and At-Bash to Kashghar crosses over the Tash-Rabat (or Tash-Robat) and Turugart passes, skirting the eastern extremity of the lake. Another route from the Turugart pass runs along the southern shore of the lake and over the low Tuz-bel (or Tuz-bol) pass to Andizhan (Andijan), with a branch to the Narin fortress. Heavily laden caravans take this route to Narin, though longer, for it crosses easier passes. The water, though the lake has no

visible outlet, is sweet, except at the east, where the bottom is of clay impregnated with salt. The Kirghiz say that seventy years ago a Sart was crossing over the ice when his ass fell in, and that the saddle was afterwards found in the stream Jaman-su, near Turfan, at a distance of 210 miles, in a straight line, from Chatir-kul. If this be true, the lake must have a subterranean connection with the

The Chatir-kul.

Jaman-su, a tributary of the Kok-shaal, on which Turfan stands, which in its turn flows into the Ak-sai. (M. P. Bogdanov in the *Izvestiya* of the Russ. Geogr. Soc., No. 3, 1900.)—W. A. T.

AFRICA.

Great Britain, Egypt, and the Sudan.—In his Report on Egypt Lord Cromer elucidates the relation that holds between Great Britain and Egypt regarding the Sudan territories. The contribution provided by the Egyptian Government to meet the charges of the civil administration of the Sudan has been increased from £E134,000, the figure of 1900, to £E194,000 in 1901. On the other hand, the military expenditure chargeable to the Sudan has been reduced by £E60,000. The total sum disbursed by the Egyptian Treasury remains, therefore, the same as in 1900, viz., £E417,000. That this is a heavy charge, he says, cannot be doubted. Indeed, in his opinion, the most remarkable feature about the reoccupation of the Sudan is the ease with which this heavy additional burthen has been borne without for a moment seriously endangering the stability of Egyptian finance. It affords, perhaps more than any other single fact, very strong proof of the great recuperative power with which Egypt has by nature been endowed.

There does not at present appear, however, to be any immediate prospect that the charge on the Egyptian Treasury on account of the Sudan will be sensibly diminished. The advantage which Egypt gains in return for this large expenditure of money cannot be altogether expressed in figures. They are, nevertheless, very real. The country has been relieved from the dread of Dervish invasion. All fear of interference with the water-supply, on which the prosperity of Egypt depends, is removed. Indeed, the path is prepared for inquiry as to whether, in the country formerly dominated by the Dervishes, works may not be executed which will eventually prove of the utmost service to all the inhabitants of the Nile valley. Trade, which cannot fail to benefit Egypt generally, has sprung up, and is certainly destined to increase as time goes on. The necessity for maintaining so large an Egyptian army no longer exists. The burthen of military service has already been lightened. Lastly—and this is an argument which, he hopes and believes, appeals to Egyptians as well as to his own countrymen, who co-operated with them in the civilising work of reconquest—the stigma that a large tract of country, formerly under Egyptian rule, had been allowed to lapse into barbarism, has been removed. "I observe," he says, "in the remarks of the Legislative Council on the Estimates for the current year, that it is stated that the Council approves of the proposed expenditure on the Sudan, as they consider that the country 'forms an integral part of Egypt.' That view is substantially correct. The political *régime* in the Sudan is, however, governed by the convention between Great Britain and Egypt, signed on the 19th January 1899. As it is possible that some Members of the Legislative Council may not be fully acquainted with the purport of that instrument, I take this opportunity of explaining that it was not framed with any wish or intention to curtail the legitimate rights of Egypt. The main objects of its authors were: first, to ensure good government to the people of the Sudan; and secondly, to avert from that country the special complications to which an international *régime* has given rise in Egypt. The Members of the Council are, I conceive, not unaware of the manifold inconveniences to which those complications are liable to lead. I notice also that the Legislative Council ask that they should, for the future, be furnished with the details of the revenue and expenditure of the Sudan. There cannot, of course, be the smallest objection to complying with this request. The Sudan Estimates for the current year have, therefore, been communicated to the Council."—*Egypt*, No. 1, 1901 (Cd. 441), p. 4.

Delimitation of the Egyptian Sudan.—The Sirdar and Governor-General in his Report on the Egyptian Sudan for 1900, which is included by Lord Cromer in his own Report on Egypt, gives some particulars regarding the question of delimitation. As regards the Eastern District, he says the negotiations between the Sudan and the Italian Colony of Erythræa with reference to frontier settlements have been continued, but the actual delimitation of the ground has not yet been carried out. It is probable this will shortly be undertaken. Lieutenant-Colonel Talbot, R.E., Director of Surveys, has been employed in surveying the various districts under consideration, and the results of his labours will, no doubt, greatly facilitate the eventual delimitation. The very friendly relations existing between the British and Abyssinian Governments will, it is hoped, contribute to an early and mutually satisfactory settlement of the frontier between the Sudan and Abyssinia. In connection with this question the following preliminary surveys have been carried out. From Famaka on the Blue Nile to the Sudan Government Station of Nasr (or Nasser) on the Sobat river a survey has been made under the direction of Major Gwynn, R.E. This expedition executed accurate topographical sketches of all the country visited, besides bringing back valuable reports on all

the routes traversed by them. Major Gwynn has now proceeded to the Abyssinian capital with a view to carrying out further surveys in the same direction, on the conclusion of the frontier negotiations between Lieutenant-Colonel Harrington and the Emperor Menilek. A survey has been made under the direction of Major Austin, R.E., from Fashoda up the Sobat and Baro rivers to Gore, and thence in a southerly direction to Gelo, returning by way of the Pibor river to Nasr (or Nasser). Owing to a misunderstanding on the part of the Abyssinian frontier authorities, this expedition was unable to proceed, as was originally intended, to Lake Rudolf; but Major Austin has now started again for the lake, and it is anticipated that he will meet with no further difficulties of this nature. —*Ibid.* p. 66.

The Great Plateau of South Africa.—At the April meeting of the South African Philosophical Society, Professor J. T. Morrison communicated a paper on "Some Pressure and Temperature Results for the Great Plateau of South Africa," by Mr. J. R. Sutton, M.A., in which the author discussed the annual run of daily maximum and minimum temperatures, and of daily barometric pressures at Kimberley and Durban, as deduced from observations made during the ten years 1888-1897, the pressures at Kimberley being, however, available only for 1890-97. The object was to discover the outstanding features of plateau meteorology. The chief results were the following: (1) The mean pressure curves of the two places are practically identical in shape, the mean daily differences being something over four inches throughout the year, with certain minor periods of approach and recession. (2) The principal general differences between the temperature curves of the two places are just such as would be expected from the contrast of continental and coast stations: the mean daily temperature ranging from 44·6° (July 17) to 80·2° (December 28th) at Kimberley, and from 62·0° (July 17th), to 79·2° (January 27th) at Durban. (3) The *maximum* temperature curve at Kimberley is almost identical in shape with the *inverted* mean pressure curve at either place, the relationship being approximately that a rise of maximum temperature at Kimberley of one Fahrenheit degree is simultaneous with a fall of pressure of $\frac{1}{100}$th of an inch. (4) The Durban temperatures lag very considerably behind those of Kimberley in the summer months at any rate. (5) The general run of the *maximum* temperature at Kimberley is very closely accounted for by a formula involving the heat received from the sun at midday, the rises of maximum temperature from day to day being in almost exact proportion to the corresponding increases of the midday radiation of the sun. (6) The author has tested by hourly observations at Kenilworth (Kimberley), Cordoba (South America), and Hong Kong whether a similar relation holds between the forenoon rises of temperature and the corresponding increases of solar radiation. He finds that at different seasons of the year the same increase in solar radiation causes rises of temperature in the forenoon that are inversely as the excess of the initial forenoon temperature over some fixed temperature, which for Kimberley is 28·1° Fahr. (7) The lag of the yearly maximum and minimum of maximum daily temperature at Durban is due to the ocean, and this ocean effect is distinctly perceptible at the middle observing stations of South Africa (average distance from coast 73 miles, average height above sea-level 2300 feet). (8) The fall of temperature with height on the South African Plateau differs from its free-air value and is about 1° Fahr. in 440 feet. (9) The departures from the smooth annual curve of temperature generally take at both Kimberley and Durban the form of sharp, sudden depressions, and gentler and more prolonged elevations: but the positive and negative departures from the smooth curves of pressure are nearly alike. (10) The

annual ranges of mean barometric pressure at Kimberley and Durban are alike, ·245 inch at Durban, ·242 inch at Kimberley, while the yearly means are 30·103 inches at Durban and 26·040. The author considers the great annual range at Kimberley as probably a typical plateau phenomenon, and discusses carefully the relative differences of pressure at the two stations throughout the year. (11) The formula connecting barometric pressure with height above sea-level deduced from Kimberley and Durban is in fair concordance with the available data from intermediate stations. Among isolated phenomena, the author considers (12) the occasional abnormal spring hot winds of Durban, finding them to be preceded by well-marked rises both of pressure and of temperature at Kimberley; (13) he finds annual barometric depressions at the end of May and the middle of July at both places, accompanied by waves of temperature; somewhat similar waves of pressure and temperature occur at Cordoba (South America), and Adelaide (Australia), but with certain time differences, which leads the author to conclude that "we might adopt the working theory (not forgetting how easy it is to theorise when facts are few), which, however, is rather a geometrical conception than a mechanical possibility, that there is a certain temperature factor—if we may so call it—travelling round the earth from west to east, while a pressure factor is going the opposite way."

On the motion of the President, a vote of thanks was passed to Mr. Sutton for his paper, and to Professor Morrison for the trouble he had taken in summarising and placing the results before the meeting.

Cape Town, *April 30th*, 1901.

AMERICA.

British Guiana.—The population of this colony on December 31, 1899, was estimated at 287,288, as compared with 286,222 at the same date in 1898. The public health during the year 1899-1900 was fairly good; the mortality is returned at 29 per thousand. Throughout the latter part of 1899 there prevailed a severe drought: the rainfall recorded for the twelve months ending on 31st March 1900 was only 63·97 inches; the average rainfall for the preceding ten years was 108·40 inches. Owing in most part, if not entirely, to this abnormal drought in the excessively dry season from August to December 1899, the sugar crop for the year ending 31st March 1900 fell short, amounting to 84,782 tons as against 96,648 tons for the previous year, and there was a serious falling off in the export of this commodity. But there had been an increase in prices, and the total value of the sugar, rum, and molasses exported in 1899-1900 exceeded that for 1898-99 by £132,582. The imports amounted to £1,318,701, and were derived as follows:—From the United Kingdom, £747,188; from British possessions, £155,692; from the United States, £376,322; from foreign countries, £39,499. The exports amounted to £1,788,987, and were distributed as follows:—To the United Kingdom, £897,002; to British colonies, £27,619; to the United States, £832,701; to foreign countries, £31,665. The chief imports were—flour, £138,388; linen, cotton, and woollen goods, £139,254; rice, £99,342; manures, £88,121; sugar machinery, £67,019. The chief exports were—sugar, £1,101,754 (84,782 tons); bullion (raw gold), £414,627 (112,823 ounces); rum, £208,398 (3,334,361 gallons); molasses, £20,092 (385,764 gallons); balata, £12,281 (237,824 pounds); timber, £11,234 (170,632 cubic feet). The output of gold was less than 1898-99 by 325 ounces. Considerable attention was directed during the year to the acquisition of concessions for gold-dredging purposes on certain rivers of the interior, and several

have been granted, but no active operations have as yet been commenced. There are manifest signs of a revival and interest in the mineral industries. The export of raw gold by parcel-post is a new and interesting feature. Gold to the value of £166,226 was so exported. "The geological survey of the gold-bearing regions was continued during the year, and the information acquired has been, in some cases particularly, of a highly satisfactory nature. A complete handbook of the results of the surveys in the different districts, accompanied by suitable maps, is now in course of preparation by Professor J. B. Harrison, the Government geologist, to whom the colony is particularly indebted in connection with the work which has been performed for the acquisition of a more intimate knowledge of the mineral capabilities of British Guiana." The number of vessels entering were 691, with a tonnage of 332,502 tons; of which 483, with a tonnage of 328,564, entered Georgetown; 68 (3513 tons) New Amsterdam; 76 (334 tons) Springlands; 64 (91 tons) Barima. With the more liberal terms for the acquisition of Crown land introduced under the Regulations of 1898 there was an increase in the land grants, absolute grants having been taken up comprising an area of 10,925 acres. Crown land was sold for the most part at the minimum price of 15 cents per acre, fixed under the Regulations.—*Colonial Report*, Annual Series, No. 318, 1901.

Ship Canal from the Great Lakes to the Atlantic Seaboard.—According to the Deep Waterways Commission, which was appointed in 1897 to investigate and report on available routes for deep water communication between the Great Lakes and the Atlantic seaboard, the most favourable route for either a 30-foot or a 21-foot waterway is from Lake Erie to Lake Ontario *viâ* La Salle and Lewiston, and from Lake Ontario to the Hudson river *viâ* Oswego and the Mohawk valley. The estimated cost of the 21-foot waterway is $206,358,000 (£41,271,000); the annual cost of maintenance $2,343,378 (£468,700); and the maximum annual traffic capacity 36,608,000 tons. The estimated cost of the 30-foot waterway is $317,284,500 (£63,457,000); the annual cost of maintenance $2,930,308 (£586,100); and the maximum annual traffic capacity 35,180,000 tons only, owing to the difference of time which would be expended in the locks. The Commission reported, as a result of the investigation, that the 21-foot waterway promises a much greater return of value, relative to its cost, than the 30-foot waterway, the main advantage of the latter being that it would furnish the lowest cost of transport proper to markets, and permit the construction of the largest sea-going vessels on the Lakes.—*Foreign Office Report on New York and District for the Year* 1900, Annual Series, No. 2581.

NEW BOOKS.

Among the Berbers of Algeria. By Anthony Wilkin. London: T. Fisher Unwin, 1900. Pp. xiv+263. *Price* 16*s*.

It seems not improbable that to the untravelled "general reader" the question who and what are the Berbers may present somewhat of a puzzle; for British interests on the southern shores of the Mediterranean, considerable as they once were, have now faded practically out of existence. The present volume will explain the somewhat peculiar position which this race holds.

The French possession of Algeria, as is well known, lies on the north coast of

Africa, facing the Mediterranean ; so far as we are justified in calling it a civilised country (albeit a country open to high natural development—as the author remarks, "Algeria was once one of the granaries of the world, and is still a land with infinite agricultural possibilities"), it is by no means to France alone that this is due. A century ago the British and Dutch fleets, under Lord Exmouth, succeeded in overthrowing the power of the Dey, and extirpating the nest of pirates which his stronghold had become. Nevertheless, Mr. Wilkin bears fair testimony to the strenuous efforts on the part of the French to Europeanise and improve in every direction their colony ; yet he hints that it is rather the Italians and others who are best fitted to exploit the country than its actual possessors. "In Algeria," he observes, "a new Latin nation may be born, but it will be Spanish, Italian, Maltese, rather than French."

But the country of the Berbers proper is the "hinterland" of Algeria ; and the region traversed by the author is entirely that to the east of Algiers. The scenery, after leaving the sea-coast, becomes mountainous and rugged, being in fact the well-known Atlas mountain range ; and it testifies to the energy of the French Government that the fastnesses have been penetrated by railways in different directions, even to Biskra, at the borders of the desert of Sahara, which, indeed, as the writer points out, is by no means exclusively desert, but contains many oases where water is to be found, and which may thus be largely increased through systematic irrigation.

The volume is a narrative for general readers of a chiefly archæological expedition undertaken by the author and his friend, Mr. D. Randall-Maciver, the more scientific results of which have lately been published under the title of *Libyan Notes*. The Berbers amongst whose territories the author travelled were the Chawia and Kabyle races ; and they seem to have made a very favourable impression upon him, especially the former, whose strongholds are in the Aurès mountains, somewhat in the direction of Tunis ; but the author admits that these are regarded by the Kabyles somewhat in the light of "poor relations." The nomad Arab, on the other hand, seems to have incurred his wrath and indignation at every appearance ; he describes him as "indolent, vicious, and unprogressive" — "the curse of the country." The author disagrees with the hitherto generally received opinion, that the Berbers were at one time Christians ; he stoutly denies that they were ever perverts from Christianity, and earnestly maintains their faithful adherence to the faith of Islam. We seem here to detect a faint flavour of casuistical questions, which we must leave Mr Wilkin's readers to deal with for themselves. But they are certainly a remarkable people ; and the author claims for the Berbers generally that "they are white men, and in general act like white men." Of course, however, there is among the southern tribes a considerable intermixture of dark blood, and the celebrated "Touareg" of French military reports are simply a half-breed race of Berbers and negroes.

It is not after all surprising if the travellers have been somewhat affected in their description of the character of the country by the atmospheric conditions at the time they passed through it. One part of the earlier portion of their route is described as "a cross between the most uninviting tracts of Scotland and Spain !" Nevertheless a good deal of the wild Aurès region seems to bear a resemblance to the Scottish highlands. The author, however, warns intending tourists of the necessity of acclimatisation.

We must conclude with a word of approbation for the sketch-map which accompanies the volume. Plain and simple to a degree, and covering only a single page, it yet contains almost every place-name mentioned in the course of the route. The names are indeed a little illegible at times, but can be deciphered ; and

we wish that all travellers would provide their books with maps equally simple and equally useful.

An Index would have been an advantage.

The Siege of Kumassi. By Lady Hodgson. New York: Longmans, Green, and Co., 1901. *Price* 21*s.*

The appearance of this delightfully graphic and interesting work will serve to recall to our readers that in the summer of last year, when the thoughts of all were turned to the siege of Mafeking, there was going on in another part of Africa another siege, the story of which is quite as exciting and as honourable to our arms as that in connection with which the name of Baden-Powell has become a household word and has earned a place in history. The siege of Kumassi in 1900 has indeed been most fortunate in its historian. Lady Hodgson sets forth what she herself saw and experienced in simple but powerful language. There are no traces of feminine exaggeration or panic, although she does not hesitate to mention her personal fears in particular emergencies. She is also gifted with a due sense of proportion, and trivialities or unnecessary details are excluded, except now and again when they are used to lighten what might otherwise be a too sombre narrative. The story is an old one, viz., how a few hundreds of natives, themselves savages only yesterday, but trained and commanded by a handful of British officers, held out for nearly three months against hordes of hostile tribes, and ultimately to escape starvation a band of them encumbered (or should we rather say encouraged?) by having some ladies with them, fought their way through a dense jungle to a place of safety. The interest of the book never flags from beginning to end, and we gather from it much valuable information regarding the manners, customs, and habits of these wild tribes of West Africa, whose civilisation, thanks to a variety of circumstances and especially the climate, will be a task quite as formidable and as tedious as any which the British nation has ever yet undertaken.

Hints to Travellers: Scientific and General. Edited for the Council of the Royal Geographical Society. By John Coles, F.R.G.S., F.R.A.S. Eighth Edition. London: The Royal Geographical Society, 1901. 2 vols. *Price* 15*s. net.*

This is a companion that no traveller should leave behind, even if he does not go far out of the beaten track. It is well that the editor has seen fit to divide the book into two parts in this edition, as it threatened to become too large for one pocket of ordinary size, and with the enlargements of each new issue, it now promises to swell into an extensive treatise on the art of travelling, exploring, and surveying new lands. The first, and larger of the two volumes, deals entirely with "Surveying and Practical Astronomy," and is more than half occupied with astronomical tables. It has 436 pages and an index, so that it is really a separate work, that can be used and carried independently of vol. II. This is well, as there are two classes of travellers to whom such a companion is welcome, and for those who do not intend to construct maps, the second volume is the one to take, as it teaches how to keep "fit," and how and what to observe and record. This admirable little work needs no further praise, and will pass through many more editions; but when it does, it might be better to sacrifice the pages of advertisements at the end of each volume, which only add to the bulk, without in any way improving the scientific value of a work that should be, above all things, compact and concentrated from board to board.

The Indian Borderland, 1880-1900. By Colonel Sir T. Hungerford Holdich, K.C.I.E., etc. With twenty-two illustrations and a map. London: Methuen and Co., 1901. Pp. xii + 402. *Price* 15*s. net.*

Sir Thomas Holdich's book is an account of the steps by which our acquaintance with the geographical features and the peoples of the regions lying beyond the north-western frontier of India has, during the last twenty-five years, advanced from practical ignorance to complete knowledge. It further contains some account of our military and political dealings, with these regions during the same period. The record of geographical exploration and of military and political history is blended into a pleasantly written and highly interesting narrative. The author was present as survey officer with the various military expeditions and boundary commissions (of one of the latter he was also the political leader) which furnished the opportunity for exploration and observation. He therefore writes as an expert eye-witness of the scenes, and a well-informed participator in the events, which he describes. Personal experiences have thus enabled him to impart to his narrative a realistic quality which adds much to its charm; and scattered throughout the book are many graphic descriptions of scenery, and of military and other incidents, as well as shrewd estimates of Oriental methods and motives, and of possible political and commercial developments.

The illustrations are very good; the map is poor and insufficient.

Un Séjour dan l'Ile de Ceylan. Per Jules Leclercq. Paris: Plon-Nourrit et Cie., 1900. Pp. xii + 293.

M. Leclercq has travelled in many countries both of the Old and the New World, and has described them in works admirable alike for their matter and their style. Several of them, indeed, have had the distinction to be crowned by the French Academy. Our traveller came to Ceylon while his impressions of Java, which he had just left, were still fresh in his mind, and he was thus, he tells us, in a position to judge which of the two islands had the preferable claim to be called the "Terrestrial Paradise." As the result, he found himself unable to assign the palm to either, each having its own distinctive features and special charm. He first set foot on this enchanted land—the Emerald Isle of the East, known to the Greeks of old as Taprobanê—at Colombo, which is now the seat of Government and the port of call for ocean steamers instead of Point de Galle as formerly. Here he saw much that was new and strange in the aspect both of man and nature. With racy good-humour he sketches the appearance, dress, mode of life, and manners of the strangely mixed population that came under his notice as he paced along the thoroughfares of Colombo, which may be described as arcades formed by rows of stately trees, which weave overhead a leafy canopy, through which the fierce rays of the sun cannot penetrate. The native population consists of Sinhalese, descendants of the early conquerors of the island, who emigrated from the Gangetic regions; the Tamils, who came from various parts of peninsular India; and the Eurasians, with Dutch or Portuguese blood in their veins. The aborigines, called the Veddahs, who number now only a few thousands, are savages of the lowest type, and are only to be found in forest solitudes. From Colombo M. Leclercq proceeded to Point de Galle, which he takes to be the eastern Tarshish of the Phœnicians, and found this old seat of commerce fast sinking into decay. His narrative then transports us into the interior of the island, a region of mountains soaring high into the blue of heaven, clad with the rich and varied vegetation of the tropics, and presenting to the eye at every turn scenes of match-

less beauty or sublimity. Among the places which our traveller here visited were Kandy, the old capital of the Sinhalese kings; Peradiniya, noted for its botanical garden, the most beautiful in the world; and Nuwara Eliya, the famous sanatorium founded by Sir Samuel Baker. From the summit of Pedrotallagalla, which out-soars Adam's Peak by 740 feet, he saw, as from an aërial observatory, a panorama of the whole island.

We are next conducted beyond the mountains into the northern plain, a vast, desolate, swampy area, overgrown with dense jungle, the home of the wild elephant, the leopard, and the bear. This wilderness, though now very sparsely peopled, must nevertheless at one time have been inhabited by an immense population, for in its forest depths are found remains of an old and splendid civilisation buried cities as extensive as old Babylon, and ruins of religious structures which for height and magnitude must have rivalled the pyramids of Egypt. Wonderful also alike for their size and their multitude were the tanks by which the whole country was copiously irrigated. The excavator is now at work among these mighty ruins, and our author has made his work all the more valuable by his record of the explorations which are in progress at Anuradhapura. The last two chapters are full also of valuable matter—the former dealing with the history of the island from the earliest times down to the year 1815, when the Dutch, who had wrested it from the Portuguese, lost it in turn to the British, by whom it is now governed as a Crown colony, in the manner described and fairly and favourably criticised in the concluding chapter. The work is accompanied with an excellent map of Ceylon, and adorned with several pleasing illustrations of the people and scenery.

The Statesman's Year-Book. Statistical and Historical Annual of the States of the World for the Year 1901. Edited by J. Scott Keltie, LL.D., with the assistance of I. P. A. Renwick, M.A., LL.B. Thirty-eighth Annual Publication. London: Macmillan and Co., 1901. Pp. 1320. *Price* 10*s.* 6*d.*

No statistical publication in the English language excels this time-honoured annual as regards wealth of information, lucidity of treatment, and accuracy of statement. As every year it is kept up to date, each issue has to be largely rewritten. In the present edition numerous changes have been made, and their wide range may be judged by their including the annexation of the Boer States to the British Empire, the formation of the Commonwealth of Australia, and the institution of the United Free Church of Scotland. The result of recent American, European, and Indian censuses is given, whilst the section on Russia has been greatly improved through the courtesy of the Russian Embassy in London. A useful official table enables us to gauge the condition of British commerce, regarding which so many depreciatory statements have lately been made, and proves that, during the decennial period from 1891 to 1900 inclusive, the declared value of the imports and exports of merchandise of the United Kingdom has considerably increased, the value of the total imports in 1891 (an average year) being 435 millions of pounds sterling, and in 1900 523 millions; the exports of British produce being valued in 1891 at 247 millions, and in 1900 291 millions; the value of exports of foreign and colonial produce being, in 1891, 61 millions, and in 1900 63 millions; and the total imports and exports being valued in 1891 at 744 millions, and in 1900 878 millions:—the average share of the total imports and exports per head of population rising from £19, 14*s.* in 1891 to £21, 8*s.* 3*d.* in 1900. Of the total trade of the United Kingdom 90·6 per cent. falls to England and Wales, 7·9 per cent. to Scotland, and 1·5 per cent. to Ireland.

The Civilisation of the East. By Dr. Fritz Hommel. ("The Temple Primers.") London: J. M. Dent and Co., 1900. Pp. xii + 140.

A perusal of this interesting little volume, which, like others of the Temple Primer Series, is a model of condensation, leaves the reader with the firm conviction that the title of the book is a misnomer. It is not a record of civilisation, nor does it concern the East. Nowadays, when we speak of the East, we include India, China, Japan, etc., and we exclude Egypt, which, for all practical purposes, is a part of Europe. In this work India, China, and Japan find no place, and Egypt is a centre of interest. Then, instead of finding a history of civilisation, as we now understand the word, we find merely a cold, hard précis of what has been elicited regarding the history of Babylonia, Egypt, Assyria, Palestine, Nineveh, and Media from monuments, inscriptions, tablets, etc., from the dawn of history to about the fifth century before the Christian era—a history most interesting in itself, but not a history of civilisation, and one which, at the best, is incomplete and merely in the course of being elicited. Taken in the limited sense, the little volume will be acceptable to readers who are unable to grapple with the standard works of Maspero, Layard, etc.

Ethnology. By Dr. Michael Hoberlandt. Translated by J. H. Loewe. ("The Temple Primers.") London: J. M. Dent and Co., 1900. Pp. viii + 169.

We have before us the second edition of *Ethnology* from the Temple Primers, by the capable hands of Dr. Michael Hoberlandt, and the fact that a second edition was needed only three months after the issue of the first speaks well for the reception accorded to the work. It is a model of condensation, and the reader's only regret is that the learned doctor was not permitted to expand the work far beyond its present limits.

Chinese Pictures. Notes on Photographs made in China. By Mrs. J. F. Bishop, F.R.G.S. London: Cassell and Co. *Price* 3*s.* 6*d.*

This little work contains a collection of about sixty pictures illustrating the people of, and places in, China. Short descriptive notices accompany the illustrations, which are well selected and clear.

A History of Egypt in the Middle Ages. By Stanley Lane-Poole. London: Methuen and Co., 1901. Pp. 382. *Price* 6*s.*

A summary of the history of Egypt from its conquest by the Saracens in 640 to its annexation by the Ottoman Turks in 1517 is given in this volume (the sixth of the series) with that erudition which distinguishes its author, who has been assisted by various eminent Egyptologists. The book contains 101 illustrations, and a useful map of Egypt and adjacent countries. We may note that whilst Cyprus was added to the empire of Egypt in 1426 during the rule of the Circassian Mamlūks, it was in 1878 added to the empire of the present rulers of Egypt.

The Story of the War in South Africa, 1899-1900. By Captain A. T. Mahan, U.S.N. With Map and Portrait of the Author. London: Sampson Low, Marston, and Company, 1900. Pp. vi + 322, including Index. *Price* 10*s.* 6*d.*

This work, from the well-known and competent pen of its author, describes the theatre of the Boer war, and gives a critical account of the operations on both sides up to the time of the occupation of Pretoria. Sketch-maps to illustrate the various tactical positions of the opposing forces would have greatly aided the reader.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY.

By Sir Clements R. Markham, K.C.B., F.R.S., President.

At the Anniversary Meeting of the Royal Geographical Society, on May 20, 1901, the President referred to the death of Her late Majesty, Queen Victoria, Patron of the Society, and to the accession of His Majesty, King Edward VII., who has been graciously pleased to accept the office of Patron of the Society, and to intimate his intention to continue the royal premium which had been granted to the Society by his two predecessors, King William IV. and Queen Victoria. His Royal Highness the Duke of Cornwall and York has also been graciously pleased to succeed his august father as Vice-Patron of the Society.

Having referred to the retirement of Dr. H. R. Mill and Mr. Coles, and to the appointment of Mr. Heawood as Librarian, Mr. Reeves as Map Curator, and Mr. James M'Carthy as Instructor, Sir Clements Markham reviewed the work of the Society as follows:—

The geographical work which is engaging most attention at the present moment is that connected with the International Conference at Christiania, for the exploration of the ocean. It is not the first time that this Congress has met, but the present meeting is probably the largest and most representative that has yet been held. The main purpose of the Conference is to deliberate on the best means of exploring the North Atlantic, the North Sea, and the Baltic. The primary object of the study of these seas is avowedly economic: to devise means for ascertaining whether the supply of fish is declining, as is generally believed; what is the reason for such decline if it is really a fact, and the best means of preventing or checking its progress. Russia, Germany, and Norway have built vessels specially for this purpose, and have appointed their ablest men of science to carry out the necessary researches. It is

very sad to see our own country taking part in the Conference in a half-hearted way. We must still hope that England will not be behind such small States as Norway and Denmark in contributing to an investigation that will yield rich results to science, as well as for the benefit of an important industry. Not only should our fisheries profit from the results of this great international enterprise, but it is probable that data may be collected that will enable us to forecast the weather for a much longer period than is at present possible. There is now little doubt that oceanic conditions have a marked effect on the weather.

During the past year considerable progress has been made by our School of Geography at Oxford. The attendance of students is highly satisfactory, and the institution of a Geographical Diploma by the University cannot fail to have a marked effect on the position of geography both at Oxford and at our public schools. There is reason to hope that, in the reorganised University of London, geography may in time be given a place of considerable importance in examinations. There is a Board of Geographical Studies in connection with the University, of which our secretary, Mr. Mackinder, and Mr. Chisholm are members. This Board is at present considering the place which geography should hold in matriculation, intermediate, and degree examinations, in certain of the faculties. If the place accorded to this subject is what we should all desire to see, there can be little doubt that the recognition will lead to a marked improvement in geographical education throughout the country. In other directions there are gratifying signs, especially in the action of several School Boards, that geography is gradually winning its proper place in education.

Our Cambridge reader in geography, Mr. Yule Oldham, gave a course of lectures on the physical aspects of geography in the last Long Vacation, with the co-operation of Prof. Davis of Harvard. The class numbered over two hundred, including many school teachers. During the academic year, Mr. Yule Oldham has given courses of lectures at Cambridge, which have been well attended by undergraduates.

With reference to the teaching of our science, I wish to draw special attention to the enterprise of Messrs. Andrews and Dickinson, whose slides, maps, and geographical pictures are a decided improvement on anything else that is available. Both of them are geographers and experienced teachers, and it is to be hoped that they will meet with sufficient encouragement to induce them to persevere in their enterprise.

Since I addressed you at the opening meeting of the Session last November, nothing of importance has occurred in the way of exploration. Major Gibbons has described to us the valuable work he accomplished in the Barotse country, and his journey thence to Cairo. His work has been embodied in a new map of Barotse, which will not only include Major Gibbons's observations, but all the trustworthy data collected by other travellers. Mr. Ravenstein has been engaged on this map for some time, the delay in its completion being accounted for by the vast amount of detail which has to be examined and embodied.

Several communications have been received from Sir Harry Johnston, the Special Commissioner in Uganda. I gather from them that Sir

Harry, as is his wont, has been very active during the time he has spent in that region. He has made journeys to most parts of the country under his charge, and will probably leave for England by the end of May. But before starting he will make the ascent of the great extinct volcano, Mount Elgon, a mountain region of special interest to the geographer. Sir Harry will bring home with him about a thousand photographs and maps, with valuable notes, which will form an important contribution to our knowledge of Uganda. I hope that he will give us a paper on his journeys at the opening meeting of next Session.

A very distinguished African traveller has just returned from another part of that continent. General Sir Frederick Lugard has had a trying time in Nigeria during the last eighteen months. He is strongly impressed with the value of good maps in conducting the work of developing such a region as is included in the European Protectorate of Central Africa. He has, therefore, devoted especial attention to the work of surveying, and I have reason to believe that he has returned with a mass of material from which an excellent new map of Nigeria may be constructed.

An admirable scheme has been prepared by the Intelligence Department of the War Office under Sir John Ardagh, which has issued an index map of Africa on the projection and plan of the map of the world on the one-millionth scale suggested at the International Geographical Congress of 1895. All those parts of Africa which have been actually surveyed are shown on the index map. They are, at present, insignificant in extent. The scheme of the Intelligence Department is to obtain from the various Governments and Geographical Societies which have an interest in Africa, the material available for filling in the map, and to issue the sheets as they are completed. It is a very laudable undertaking, but, in order that it may have a satisfactory result, accurate surveying operations will have to be undertaken. It is hoped that our Government, in conjunction with the Colonial Governments and the local administrations in the African Protectorates, will do all in their power to carry out the careful surveys necessary for the completion of the work.

We have to lament the loss of more than one distinguished geographer since our last anniversary. Our science has suffered a serious loss in the death of our Gold Medallist, Dr. George Dawson, the Director of the Geological Survey of Canada. His successor, Dr. Robert Bell, has had many years' experience in survey work, and I feel confident that he will maintain the high level which the Canadian Survey has attained. We also have to mourn the premature deaths of our gallant young associate, David Carnegie, of Dr. Schlichter, and of Mr. Frederick Pullar, a very promising young geographer, especially in connection with lake investigations. I fear that Sir John Murray will find it difficult to secure the services of one equally competent and equally keen as a colleague to complete the work connected with British lakes which has been so well begun under his auspices.

I noticed the work of the Duke of the Abruzzi and of the Danish

lieutenant Amdrup on the East Greenland coast in my opening address last November. Mr. Baldwin and Captain Bernier have not yet started on their attempts to reach the North Pole, and we must still wait some months before we can hope to hear news of Captain Sverdrup and Lieut. Peary.

We now have before us the geographical results of Mr. Borchgrevink's expedition to the Antarctic regions, and I consider that the expedition has done valuable pioneer work. Mr. Borchgrevink has published his book, and one of his staff, Mr. Bernacchi, has read us a very interesting paper at an afternoon meeting last March; while to Mr. Colbeck we are indebted for the maps and astronomical observations. The experiences of the *Southern Cross* in the pack add useful evidence to our previous information respecting the meridians on which that formidable obstacle should be entered. During the sojourn in Robertson Bay an instructive meteorological journal was kept, and the report on the geological and biological collections will no doubt show valuable results; but it is not yet published. I consider the most useful result of the voyage of the *Southern Cross* to be the important and interesting additions to our knowledge of the nature of the coast from Coulman Island to Cape Gauss, which have been made by the observant explorers. The fact that a landing was effected without difficulty on the great ice-barrier of Ross is also a notable result of the voyage. Mr. Borchgrevink here reached the farthest south ever yet attained. I feel bound, therefore, to bear my testimony to the value of the fresh information that we have derived from Mr. Borchgrevink's expedition.

The equipment and all the arrangements connected with our own Antarctic Expedition are approaching completion. I am anxious, in this address, to impress upon my colleagues the great responsibility that has been undertaken by the two associated Societies in despatching the expedition; to recognise the cordial assistance that we have received, especially from official sources; and to recapitulate our system, our objects, and the plan of operations through which we hope to secure success.

The Royal Society and the Royal Geographical Society are both actuated by one object, the advancement of science and the gathering in of important additions to the sum of human knowledge. The ancient and illustrious body which has entered upon this great national work in co-operation with us possesses a record which, as geographers, we revere. In the days of Sir Joseph Banks the science of geography was, for forty years, one of the chief cares of the Royal Society. We do not forget this. We do not forget the debt that geography owes to the great mother Society, and we feel it to be an honour to be associated with it in this important enterprise. In the course of our mutual labours, in the consideration of so many intricate questions, I will not deny that there have been differences of opinion. This was inevitable with independent minds approaching problems from slightly different points of view. But the application of common sense will always dissolve such obstacles to a full agreement, and now I rejoice to be able to say that there is complete accord between the two Councils.

Our own Society has made great sacrifices for the promotion of a work which, I am sure, we all have at heart; and the subscriptions of our Fellows have been numerous and liberal, in one instance munificent. I desire, however, on this occasion, specially to commemorate the help we have received from the Government, and the sympathy our officers have met with in many directions. As soon as our expedition had received such an amount of support as proved that it would be a national undertaking, the First Lord of the Treasury took the question into favourable consideration. Mr. Balfour soon perceived not only that results of very great importance were to be expected from the expedition, but that its support was a matter of national and even of international consequence. This enlightened statesman obtained for us the grant from the Treasury; and we thus received a *status* which enabled the Admiralty to do something more than look upon our undertaking with favour.

As long ago as April 1897 I had an interview with the First Lord of the Admiralty, who expressed sympathy, but could not then hold out any hope of material help. He, however, promised that, if an expedition was sent out, the Admiralty would supply the scientific instruments and appliances. But the position given to us by Mr. Balfour's effectual intercession changed the attitude of the Admiralty. In April 1900 Mr. Goschen promised me two excellent officers, and since that time we have had to thank the Admiralty for much sympathetic help in many ways. Their lordships have lent us the services of no less than four naval officers, as well as petty officers and men, who are to receive pay and allowances during their absence. Stores at cost price have also been allowed to the expedition, in addition to the scientific instruments and appliances promised in 1897, which have been provided under the superintendence of the hydrographer, Sir William Wharton. Last, but assuredly not least, we are indebted to Sir William White for the invaluable services of Mr. W. E. Smith, one of the chief constructors, in designing the ship, and superintending the building throughout. The best thanks are certainly due to the Lords of the Admiralty from all who are interested in the expedition.

We also have to thank the chairman and directors of the P. and O. Steam Navigation Company for lending us the valuable services of Lieut. Armitage, R.N.R.; while the acts of kindness and sympathy from individuals have been numerous and most gratifying. Firms, such as Messrs. Colman and Messrs. Cadbury, have made liberal reductions and presents, and the publishers have been most kind in making handsome presents to the library. In all these things we recognise that warm feeling for those who are about to brave dangers and hardships for their country's credit, which has always distinguished the English people. Nor must we be unmindful of the active sympathy shown by our foreign well-wishers. Through the intervention of my friend, Dr. Don Francisco Moreno, the Argentine Government has shown its desire to help in the work of Antarctic research by liberally undertaking to establish a magnetic observatory on Staten Island. It will be in charge of a lieutenant of the Argentine navy, Don Horacio Ballvé, who is now in Europe ordering the instruments, and will dine with us

to-night. For this useful co-operation our warmest thanks are due to their Excellencies, the Argentine Minister of Foreign Affairs, and Señor Dominguez, the Argentine Minister in this country, and to Dr. Moreno.

All who know anything of his work during the last nine months must feel that in Commander Scott we have got the right man in the right place. To him alone is due the advanced state of the preparations. With a genius for organisation, a clear head, an unfailing memory, he has seen to every detail himself, while he has made himself master of the problems that we look to him to solve. All this gives bright promise of what we may expect from this able and resourceful young officer in dealing with the sterner work that is before him. He is most ably supported. In Lieut. Armitage we have an accomplished navigator, of great Arctic experience, and with a long training in sledge-travelling. Lieut. Royds, a nephew of Wyatt Rawson, who was the finest type of an Arctic officer, Lieut. Michael Barne, Mr. Ernest Shackleton, Mr. Reginald Skelton, the engineer, Dr. Koettlitz, who also has Arctic experience, and Dr. Wilson, an excellent artist, will form the staff of officers of the ship. There will also be a geologist, a biologist, Mr. Hodgson, and a physicist, Mr. W. Shackleton, to conduct investigations in their several departments. Mr. Hodgson has been for a cruise in the *Michael Sars* with Dr. Hjort, while Lieut. Royds has been to the summit of Ben Nevis, in mid-winter, to see the recording system for meteorological observations obtaining there, and to Lerwick after men. All are actively employed.

Mr. George Murray, of the British Museum, will direct the operations of the civilian staff during the passage out, and will get everything connected with their departments into thoroughly good working order. The magnetic observations, under the special supervision of the commander, will consist of a magnetic survey right round the world to the south of the 40th parallel, during the voyages out and home, across the oceans. This will be the principal magnetic work. Special interest attaches to the area in which the maximum magnetic intensity is expected to be found, south of Australia, and this area will be traversed. Observations will also be taken as far south as possible in the Ross sea. The commander will establish a magnetic base station at one of the observatories, either Melbourne or Christ Church, New Zealand, and a secondary magnetic base at his winter quarters. Meteorological observations will be taken every two hours, and at Greenwich noon, throughout the period of the expedition. At the winter quarters, which will be south of the 74th parallel, they will have a special interest with reference to the anti-cyclone supposed to exist from about 74° south to the pole. These observations will all be under the direct supervision of the commander.

Deep-sea soundings will be taken, whenever it is possible, with serial temperatures, and samples of sea-water at various depths will be obtained for physical and chemical analysis. Tidal observations will be taken at the winter quarters. Dredging operations will be carried on whenever the circumstances are favourable, and it is the intention of the commander to dredge at considerable depths, so as to make the collection of Antarctic flora and fauna as comprehensive as possible.

At my request, Mr. George Murray has undertaken to edit the

Antarctic Manual, which will be the work of various contributors, and will, as far as possible, embrace all that is known of the phenomena of the Antarctic Regions in the various branches of science. Our assistant draughtsman, Mr. Batchelor, has prepared the maps under my superintendence. The Manual will be most valuable to the officers, and will also be issued, as an extra volume, to our Fellows. The *Antarctic Manual* will be dedicated, at Mr. George Murray's suggestion, to Sir Joseph Hooker, the venerable survivor of Sir James Ross's Antarctic Expedition.

The all-important measures, with reference to the conveyance of these trained officers and scientific civilians to their destined work, are connected with the provision of a suitable ship. This was, of course, the first question which engaged our attention. I ascertained the capabilities of existing vessels belonging to Scotland and Norway, and arrived at the conclusion that, effectually to meet and overcome the difficulties and dangers of the Antarctic pack, it would be necessary to build an exploring ship specially designed for navigation in the southern ice. On April 5, 1899, in reply to my application, Sir William White was so good as to suggest to me that I might secure the services of Mr. W. E. Smith, one of the chief constructors, as architect of the exploring ship, and, most fortunately for the expedition, Mr. Smith was able to accept my proposal. I then called together a ship committee of Arctic officers, who decided the general lines for the ship, and on April 17 Mr. Smith completed the plans. It was further decided, in May, on the representation of Captain Creak, that the magnetic observatory should have no steel or iron within 30 feet of it. This arrangement involved considerable expense and some sacrifice in other respects; but we feel assured that the value of the results will amply repay us.

The only firm in the kingdom that could undertake to build such a ship was the Dundee Shipbuilding Company, and their tender was accepted in December 1899. It was no easy task to collect the oak timber and other materials; nor could a sufficient number of wooden shipwrights be found anywhere else. I feel bound to bear my special testimony to the excellence of the work done by Messrs. Gourlay, the firm which built the engine. Our thanks are also due to our able architect, Mr. Smith; and to the chairman and secretary of the Ship Committee, Admiral Sir Leopold M'Clintock and Admiral Markham. Admiral Sir Anthony Hoskins should also receive the warmest thanks from all who are connected with or interested in the expedition, for his indefatigable and successful exertions on its behalf.

The naming of the ship was not an unimportant matter. Out of twenty names I selected that name which best described her work, the work of discovery. In 1881 I edited the voyages of William Baffin, who discovered the bay which bears his name two hundred and eighty-five years ago, and I remembered that his little vessel was named the *Discovery*. The first lunar observation ever taken by an English sailor was made on board her, as well as other scientific work which constituted her the prototype of exploring ships. Vancouver's ship had the same name, and so had one of Captain Cook's ships when Icy Cape was

sighted; so had Sir Harry Stephenson's ship, built in the same yard, which carried such men as Beaumont and Wyatt Rawson to the polar regions. It is a good name, worthily borne by ships of renown in the days of old: so on March 21, 1901, Lady Markham launched our Antarctic ship at Dundee, and named her the *Discovery*. She is one of the strongest ships ever constructed for ice-navigation, and the first ship ever built in this country specially for exploration and discovery. I am glad to be able to announce that the results of her trial trip last week were perfectly satisfactory. The *Discovery* will be handed over to Captain Scott in a few days, and will be brought round to the East India Docks by the end of the month. Our special thanks are due to Mr. C. Scott and the directors of the London and India Docks Committee for their liberality in resolving not to make any charge whatever to the *Discovery* for the use of their dock. Our Council has undertaken the duties and responsibilities of ownership, and your President will have to be "director" in accordance with the provisions of the Act of Parliament.

We have thus got the ship, and the scientific appliances, and right good men to navigate the ship and use the instruments. It remains to report to you the plan of operations. For a small expedition with a single ship, the wisest course is to work from the known to the unknown, and this can only be done in the Victoria and Ross Quadrants, embracing the meridians from 90° E. across 180° to 90° W. Accordingly, I arranged with Dr. von Drygalski, the Commander of the German Expedition, in October 1899, that our sphere of work should be the Victoria and Ross Quadrants, while the Germans undertook the Enderby Quadrant.

Assuming that the exploring period will consist of two navigable seasons and one winter, the ice-pack should be sighted in December 1901, and the ship should be forced through the ice on a meridian which the commander, after careful consideration of previous voyages, may decide upon as likely to be least encumbered with pack-ice. The whole navigable season, after reaching the south water, will be devoted to exploration in the ship. She will be taken down the east coast of Victoria Land, where open water may be expected, and eastward along the famous range of ice-cliffs discovered by Sir James Ross. An examination of this barrier, with a view to discovering the nature and origin of the ice-mass of which it forms the northern termination, is one of the principal objects of the expedition.

For sixty years this astonishing geographical phenomenon has been a subject of interest and speculation. It was supposed, by the late Mr. Croll and others, that the ice-cliffs were the termination of a vast ice-cap extending to the South Pole. Mr. Bernacchi believes that the cliffs are one side of a glacial flow from the Parry mountains, a huge tongue of ice, and his chief reason for this opinion is that the slope is from west to east, not from south to north. His paper on the subject, which was read at an afternoon meeting last March, at which Sir Joseph Hooker and Mr. Blanford were present, was interesting and suggestive. My own impression is that the ice-cliffs terminate a glacial mass between two mountain ranges, and thus fill an extensive

sound or gulf. I think Mr. Blanford concurs in this view. The solution of this problem would be a brilliant result of the navigable season of 1901-2. Captain Scott will probably endeavour to advance eastward beyond the point reached by Sir James Ross, and it may be hoped that he will either discover the existence of land, or ascertain that land does not exist in that direction. The commander intends, if possible, to add a captive balloon to his equipment, a course which is strongly advocated by Sir Joseph Hooker.

But it is desirable that the expedition should return to the east coast of Victoria Land in time to establish the ship in safe winter quarters, if Captain Scott, in the exercise of the discretion that will be given to him, should consider that course advisable. It is a well-established canon, based on all former experience, that, in order to secure the best results for a polar expedition, the ship must winter. Sir James Ross fully intended to winter, and made a strenuous effort to find winter quarters. The leader of the German Expedition fully intends that his ship shall winter. Indeed, the observations which are among the results we seek, and the all-important exploration by land, could only be carried out by the whole force of the expedition, which at best is not numerically too strong.

I therefore trust that Captain Scott may be able to find safe winter quarters for the ship. The evidence of the staff of the *Southern Cross* is that there are such winter quarters at Wood Bay in 74 25′ S. There may be others farther south, and possibly in M'Murdo Bay. But it has been necessary to confine the area within which the ship may winter between Cape Johnson, the northern point of Wood Bay, and Cape Crozier, at the foot of Mount Terror. These limits are fixed so that, in the event of accident or detention, the ship may be easily found. Every arrangement has been made for wintering, and there will be three years' provisions on board.

The work of the dark months of winter will be occupied by observations of various kinds, taken by a staff efficiently trained and sufficiently numerous. Observatory huts will be erected on shore. In Wood Bay there is a level area of 150 acres suitable for this purpose. There will be a hut for magnetic observations, the instruments including a magnetograph. The meteorological observations will be regularly taken on shore as on board, and Captain Scott is considering the advisability of flying specially constructed kites with meteorographs. He will also be supplied with electric thermometry. Pendulum observations will be taken with an instrument supplied in this country; and Captain Scott will also install a seismological observatory with the instrument recommended by Prof. Milne. Tidal observations will be regularly taken. For all this work there will be a sufficient number of observers, but certainly not too many: and the dark winter months will be most usefully employed.

With the arrival of the sun the great land exploration work of the expedition will commence. Captain Scott has received complete details respecting every phase of sledge-travelling from Sir Leopold M'Clintock and Dr. Nansen, and has personally superintended the preparation of all the different articles of equipment. He has obtained a small supply of

dogs from Siberia, and will perhaps take some of those belonging to Sir George Newnes from Stewart Island. In Lieut. Armitage the commander will have the valuable help of an officer who has had great previous experience during four seasons of dog-sledge travelling. The conditions of Antarctic travelling are unknown. It is probable that dogs will be available in some directions, and that different methods may have to be adopted in others, much depending on the weather, and nearly everything else on the character of the country. But Captain Scott will doubtless adapt his methods to the exigencies of each case.

One sledging expedition, supported by depôts, will be directed due south; and we learn from the observant staff of the *Southern Cross* that the way round the eastern shoulder of Mount Melbourne, and along the ice-foot to M'Murdo Bay, presents little difficulty. Another party will probably be told off to examine the volcanic region of Mount Erebus. But the most important route will doubtless be to the westward, between Cape Gauss and Washington, where the land is low, where no distant mountains can be seen, and in which direction, by a system of carefully thought-out depôts, a great distance may be reached, entailing important discoveries.

In this sledge-travelling I look hopefully forward to great results. To my mind this is the most important work of the expedition. Our explorers will, we earnestly trust, return safely, and without serious loss or injury, to the ship. But the difficulties will be great, the perils numerous.

Then will come the labour of cutting and blasting the ship out of the ice, and no better man could be in charge of such an operation than a torpedo officer. There is reason to hope that a ship may be cut out of the ice at an earlier period of the navigable season than that in which she can be expected to reach the land from outside.

It may be anticipated, therefore, that further exploratory work may be undertaken during the second navigable season of 1902-3. There are discoveries of great interest to be made westward of Cape Adare, either by pushing beyond Cape North or by examining the sea near the Antarctic circle, between the meridians of 160° and 110 E. The question whether there is continuous land, or only a group of islands in this direction, is a geographical problem of great interest which still awaits solution. The *Discovery* would return to her base station, at Lyttleton (New Zealand), in April 1903, to recruit men and officers, and fill up with coals and fresh provisions. She would then proceed with her magnetic survey across the Pacific, returning to this country in August.

This will be a very glorious achievement, even if one quarter of what is contemplated and suggested can be done; for the difficulties and dangers of the undertaking cannot be exaggerated. We who send our gallant countrymen forth on this hazardous enterprise are bound to see that all has been done that human foresight can devise to ensure their comfort and safety. It is necessary that there should be a second ship ready to proceed south in November 1902, in the possible contingency

of any accident, or of the detention of the *Discovery*. It is also very desirable that there should be sufficient funds for a third year. But the first of these objects is essential. There must be a tender to the *Discovery*—a second ship. The required funds must be raised. The feeling that this is necessary is becoming strong among those of our Fellows who have a sense of responsibility. I have just received a letter from a Fellow of this Society, who writes as follows: "On the assumption that the instructions for the conduct of the National Antarctic Expedition are definitely settled to the satisfaction of our Council, I shall be glad to contribute £5000 towards the provision of a second ship, the necessary tender to the *Discovery*." Another wellwisher has promised £500. We have thus had noble examples set before us. We are all bound to use our utmost endeavours to see that those examples are followed. It is our duty to see that all due precautions are taken for the safety of the gallant men who are going upon a perilous enterprise at our behest.

BASUTOLAND AND THE BASUTOS.

By Sir Godfrey Lagden, K.C.M.G., Commissioner for Native Affairs in the Transvaal, late Resident Commissioner, Basutoland.

(*Read at a Meeting of the Society, Edinburgh, on June* 3, 1901.)

I am very sensible of the honour of being invited to address the Royal Scottish Geographical Society at Edinburgh. The opportunity also affords me the great advantage of getting a first glimpse of your magnificent city.

I am unaware of the reason which inspired the invitation, except it be the keenness and enterprise proverbial of Scotch men and Scotch societies to gain world-wide information, and to encourage travellers in the assurance that a common interest is taken in their studies and observations.

The substance of the paper I am about to read was composed at the request of, and read before, the Royal Colonial Institute in London.

Of the many interesting native territories in South Africa, probably none have enjoyed less notoriety until the present war than Basutoland; not because it was undeserving of prominence, but that it was happy in having no recent history to make it seriously conspicuous. For this its best friends are thankful.

Its earlier history is full of thrilling incident and romance. A glance at the map shows its remarkable position, wedged in between the civilised states of South Africa—that is, between Cape Colony, Orange River Colony, Transvaal, and Natal. How for those many years it managed to preserve its entity as a tribe is a matter no less of wonder than surprise—of wonder, because nearly all others similarly situated have lost their individuality—of surprise, because of its value for climatic, agricultural, and other reasons. At intervals the territory has been on the verge of incorporation with the Republics. Once indeed it

was practically absorbed by the Orange Free State, and might have so remained but for the inability of a scattered and disorganised population of Boer farmers to maintain their hold sufficiently long to claim the right or the power to govern.

It is necessary to treat briefly of its geography, well known though it be, because of the light it throws upon the history and character of its people. For Africa offers no exception to the general rules under which human races are moulded to some extent according to their environment.

Basutoland is, roughly speaking, about the size of Belgium. It is unsurveyed, the estimated area being somewhat over 10,000 square miles. Traversing almost its entire length from north-west to north-east are the Maluti mountains, sometimes described as the backbone of the Drakensberg range. These mountains attain to an elevation approximately of 12,000 feet, and extend over the greater part of the country, which may be generally described as an elevated plateau, extremely irregular, its contour being of the most broken and rugged nature. They form the watershed of certain large rivers, the Orange or Sinqu and Tugela in particular taking their rise at one spot called the "Mont aux Sources," and abruptly parting company to cleave their way in opposite directions. The locality is a veritable "parting of waterways," and is a favourite resort of those travellers who are able to face the extremely rough journey necessary in reaching it. The whole area is a network of rivers, which make the matter of travelling troublesome, even dangerous, for the beds are as a rule full of smooth and slippery boulders, and in flood after heavy rains the waters are strong and treacherous. During the winter season, from May to August, the higher altitudes are generally topped with snow, which remains on the southern slopes for months together in protected places where the sun does not penetrate. Rarely a season passes without snow falling heavily on the lower plateaux in the valleys of the Orange and Caledon rivers. On various occasions a carpet of snow has covered the ground at Maseru for three days together. This is mentioned to show the duration of severe weather in the otherwise semi-tropical climate.

The climate itself may be described as almost perfect. The mean temperature averages about 60°, with average maximum of 95°, and minimum of 17°. Frost prevails throughout the winter. It is a common thing to see ponds frozen hard. With such high altitude and exhilarating air the general health conditions, to which reference will be made later on, are naturally good.

The land trends from the mountains towards the open river valleys in distinctly abrupt form. Viewed at a distance, the mountains appear to be dark, perpendicular barriers, more especially on the Natal side. Below these barriers the country has the appearance of a mass of cone-topped hills which seem to flatten out across picturesque valleys towards the river levels. Lying in these valleys is a wealth of agricultural land containing deposits of rich soil still full of fertility in spite of the annual demand made upon them for crops. Interspersed are patches of green pastures upon which horses and small stock principally feed, there being

insufficient grass for herds of cattle. The traveller is surprised to find that the valleys lying between the inner mountains are also opened out for agriculture, though it is marvellous to think how ploughs could ever have scaled some of the paths by which they must have gone.

Turning to the history of the country, which can only now be briefly summarised :—

The Basutos as presently known are a conglomerate of various tribes who were first smashed and then scattered by the great warrior chief Mosilikatze, who in the early part of the last century struck terror into many of the Kaffir races of South Africa. He was a man of renown, remembered in the present day as a sort of warrior god. His remarkable reign of terror is a landmark in history. Men who cling to the memory of the martial days of old quote him and his deeds of fame. His bloody track lay through Basutoland, where he received his first check, being baffled by the hardy mountaineers, who, fearing to go out into the open, rolled down stones upon his victorious armies and humoured him by sending presents of food. He is said, as he shook off the dust of the country, to have remarked to his army, "This is no place for us ; we can fight men, but not monkeys who live in caves!"

It was about this time that one of the most famous of Kaffir chiefs rose to eminence, a unique eminence indeed, acquired by constructing and consolidating into one mass a desperate lot of thieves, robbers, rogues, and fugitives who spoke a babel of tongues to begin with, and ended in speaking the one common tongue of Sesuto. Thus it is that to-day the nation comprises Basuto, Bataung, Batembu, Bapushudi, Batlokoa, Bapedi, Makoakoa, Baphuti, Fingoes, and other clans. The name of that chief was Moshesh. His extraction was good ; but space does not admit of genealogical trees. He was a man of commanding mind, even of genius : he was cruel, as required by the times he lived in and the mob he had to rule. When his ascendency had been properly felt, he was able to hold his people together by firm persuasion, joined to a ruthless treatment of any who defied him. He abolished cannibalism by sending the cannibals freely presents of cattle for food, until the taste for human flesh had disappeared. His first great work was to moderate the savage tendencies and thieving propensities of his wild subjects, and then, having formed a public opinion and generated some collective ideas of future policy, he divided the country into wards, placed over them chosen men of good blood who owned loyal fealty to his chieftainship, and set himself to preserve the country he had made in order to bequeath an inheritance to his successors. They were many, for he had 130 wives. In accomplishing this he brought into play certain characteristics common to his race, such as cunning and duplicity, together with unusual ability, plausibility, and a capacity for holding happy communication with those of the white peoples who were opposed to him or whose sympathy he wished to gain.

The power of the tribe thus roughly fashioned by Moshesh was soon felt by his civilised neighbours. It became a menace to the farmers and squatters along the border ; thefts and reprisals provoked open war, which extended intermittently over many years, leading alternately to partial

occupation and abandonment of Basuto territory by the Boers. In 1852 the British Government became involved, and General Sir George Cathcart with a strong force invaded Basutoland. There are many living who can recall the tragic circumstances under which a squadron of the 9th Lancers was lured to its destruction and almost annihilated by the tricky exposure on the Berea mountain of a large herd of cattle. The cattle were of course a rich prize. Under this temptation the unfortunate squadron scaled a precipitous pass, and, when well mixed up between cattle and rough ground, was cut to pieces with assegais.

Moshesh is commonly believed to have held his own well. But he cleverly affected to be beaten, and induced the troops to withdraw on receiving his promise of good behaviour and payment of a considerable cattle fine. What followed in later years has always been a matter of sore feeling amongst the Dutch Boers, they holding that they were robbed of the fruits of their victory and sacrifices by the British Government, who authorised Sir Philip Wodehouse in 1868 to recognise the independence of Moshesh and to treat his tribe as British subjects. It is not of advantage to indulge now in opinions as to the justice and utility of that step. Three years of unsettlement ensued, in which the hazards of holding a loose Protectorate over lawless and uncontrolled people were made manifest. Then in 1871 Basutoland was annexed to the Colony of the Cape of Good Hope, becoming subject to the general laws of that Colony, administered by a Governor's agent and his magistrates.

Subsequently there were periods broken by trouble and unhappiness. In 1879 Moirosi, chief of the Baphuti clan, defied the Cape Government. War with him ensued, in which a majority of the people, while professing to be loyal, sympathised with the insurgents. Disaffection ripened into rebellion later on when the Cape Peace Preservation Act, providing for general disarmament, was applied to Basutoland. The prolonged war that followed in 1880-81, commonly known as the "Gun War," was disastrous in that the Colonial forces met with several reverses, and that in the end peace was made before the Basutos were brought into a state of subjection. The Basutos in their own minds have always inclined to the belief that they were successful and invincible. This presumption bred in them a certain contempt and insolence, which made future treatment of them a matter of considerable embarrassment.

In 1883 the current of feeling in the Cape Colony set so strongly in favour of being rid of the turbulent Basuto incubus that measures were framed providing for its entire abandonment and for the payment of an annual sum towards the cost of administration in lieu of customs dues on goods imported, on condition that the Imperial Government would assume control. Negotiations in 1884 finally resulted in the assumption of control by Her Majesty's Government, who appointed Sir Marshal Clarke to be the first Resident Commissioner. He found the country in a state of confusion, and with a few selected officers had to build up the fabric of administration by the slowest degrees. Resulting from the "Gun War" there was a heritage of bitter cleavage between loyals and rebels; the territory was overrun by wild characters; there were a

number of brandy canteens carrying on open trade; the general condition was one of lawlessness and impatience of control. To Sir Marshal Clarke is due the credit for evolving order out of chaos and for inaugurating the system which prevails to-day. Having gone there with him in 1884 and remained for sixteen years, I am in a position to know what changes have occurred, how they were brought about, and with what results.

It may be well at this point to say a few words about the system of control.

The management and control of natives in South Africa are complex questions upon which there are wide differences of opinion, accentuated more than usual at the present moment. To treat of the subject at any time is to venture on thorny ground. It is nearly always found that those who have had wide experience are most conscious how much they have yet to learn, and recoil at the idea of formulating theories and solutions. Some of the most versatile writers, whose confidence is to be envied, see the road quite clear and make it appear easy. It is not necessary for them to have been in Africa so long as they could derive impressions from those who represented Savage Africa at the Earl's Court Exhibition.

Much depends, and always will depend, upon the present circumstances and antecedents of native communities. We have seen the Basutos engaged in a series of bloody wars, emerging from them unbroken, with many influential friends and bodies of men still partial to them, and their land intact. Her late Majesty's Government perceived in these mountaineers, not only a sturdy desire for independence, but a sensible desire to conform to such rules and regulations as were necessary for their guidance and management; and, in framing the outline of a constitution, most generously accorded them a conditional measure of self-government under the tutelage of British officers.

The land system in Basutoland lent itself well to this concession. Under it the soil is held for the people on communal tenure by the paramount chief and again held in trust for him by the Government; that is to say, the paramount chief retains the power to apportion ground for tribal use; but neither he nor his retainers can alienate for any purpose, nor is title granted. Any portions required by Government missions, trading-stations, and suchlike are loaned, and if occupation for any reason ceases they revert to the trustees. Plots for trading-stations may on change of principals be transferred but not sold with buildings. Should a station be abandoned the buildings are removed. The chief assigns to the people arable land under the feudal system of rendering personal service. All grazing is communal.

There are, as we know, many politicians who condemn this system, considering it unfair to those who claim beneficial occupation, and that it places the common people too much in the chief's power, making it possible for him to coerce them against their wills into tribal fighting, rebellion, or war. It would be idle to dispute the strength of this plea. Yet it *is* a system, which it is wise to retain until circumstances justify the substitution of a better one. The same school of thinkers holds any system to be faulty that maintains any form of chieftainship. That

system again has its advantages as well as its drawbacks. Any sudden wrenching of the ties binding the chiefs to the people involves serious risks. The alternative, according to existing schemes, is disintegration and extended white control with all the unsuitable machinery of judicial courts, their usage and retainers.

The self-government accorded to the Basuto was never laid down in any elaborate form. A code of regulations relating to procedure in civil and criminal cases, appeals, taxes, licences, and prohibiting import or sale of arms and liquor was proclaimed as of law; the statute law of the Cape Colony was held to apply as specially required, though no ordinance passed after March 1884 was operative unless applied by specific proclamation. Tentative measures, adopted at first for guidance of the chiefs, fell into a groove, and then certain useful but unwritten rules became established by force of custom. Subject to certain reservations, the chiefs were allowed to deal with all ordinary cases between native and native. They were debarred from treating cases of homicide, or violence with intent, cases between whites and blacks, or any in which foreigners were concerned. Their national customs, when not brutal or grossly repugnant to civilised thought, were not interfered with. In the course of years, legal provision was made for the employment of native assessors to assist magistrates, for combined courts, for the extradition of criminals, for participation in customs conventions, and suchlike. These laws and regulations are printed in book form. At intervals a strong feeling was evinced to be allowed a national council. Ten years ago the desire for it appeared so marked that the High Commissioner approved proposals. Subsequently the form and constitution of a consultative council, with the scope to be assigned to it, were formulated, the design being to give the people opportunity of indicating their wishes and affording advice on matters pertaining to domestic affairs.

For reasons never clearly apparent, however, a considerable faction became later on less in favour of it, and as the policy was to abstain from bringing any pressure but rather to let the desire be entirely spontaneous, the question lapsed for the time.

To do justice to the chiefs, it must be admitted that as a body and in large measure they justified the confidence reposed in them. In their courts, though they were not always free from taint, justice was on the whole fairly administered. They acted as Government police, procuring evidence, arresting and producing criminals, collecting taxes, and generally responding to instructions for the better preservation of law and order. With the exception of certain debauched and contumacious individuals, they suffered themselves to be guided, and proved worthy, as a general rule, of the consideration accorded to them by Her Majesty's Government, capable alike of work and responsibility requiring intelligence.

It may be supposed that a tribe of natives in actual contact and occasional conflict with civilised states, yet still prospering, possesses characteristics of no common order. This is true. The Basuto chiefs, excepting some juniors whose attempts to be despotic and licentious are epidemic and who are always to be accounted a danger, possess

in no ordinary degree the capacity for ruling and being ruled. Though powerful in numbers (40,000 is the estimate of fighting men), brave and exceedingly mobile, they are not a warlike people—that is, their habits are quiet and their ideas peaceful. When moved by any sudden impulse and united, they can be, like all coloured races, hard of reasoning and blind to persuasion. Otherwise they are content to live quiet, industrious lives, law-abiding and happy, with their magistrates and missionaries. They are simple-minded, though shrewd; fond of humour, anxious to be instructed, to educate their children, and to take on new ideas and inventions. Desire for technical education took a practical shape a few years ago, when at my suggestion the paramount chief offered a suitable site for a national industrial school, and then proceeded to collect money to build it: subscriptions varied in amount from an ox valued at £10 to threepenny bits. The total handed in to be banked, pending developments, exceeded £3000. The majority are orators with prodigious memories for records. Their ability to argue and present a case is remarkable. Proverbs and metaphors are freely introduced. Persons charged with crimes almost invariably plead "not guilty" until the evidence against them becomes too strong, when they humorously give way, asking for punishment to be inflicted without undue delay.

In conversation their language is courteous, even to flattery, by which strangers are frequently misled, experienced magistrates having continually to harden themselves against its snares. To be a criminal is not to be barred from domestic circles or fellow society; they are tolerant of each other's faults, believing that temptation and opportunity are to be blamed rather than human weakness. It is quite possible to regard them as honest; of their truthfulness little can be said: they are excellent liars; but it is done so gracefully as to avoid causing annoyance, and lying is no crime. A successful liar is reckoned to be clever.

Of savage customs, only a few relics are now to be found. Some degrading practices for young people on entering the heathen schools are decaying and no longer obligatory. Amongst the Fingoes and allied clans now forming part of the population weird dances are still kept up. A few chiefs encourage them in the belief that they tend to preserve traditions and martial ideas and to delay the advance of the white men's civilisation. When the paramount chief was invited to arrange a big dance on the occasion of the visit of Sir Alfred Milner three years ago, he remonstrated with me as to its propriety, seeming almost ashamed to identify himself with the carnival in which his own sons were the principal actors.

Brief reference has already been made to the climate, which is not incorrectly described in guidebooks as magnificent. During the summer or rainy season the heat, never excessive, is tempered by cool air with refreshing nights and mornings. Winter is cold and bracing, spring and autumn delightful; the regularity of seasons is marked. With such pleasant climatic conditions and high altitude, some disadvantages are to be expected. They are to be found in the neurotic complaints from which people of European race frequently

suffer, making it essential if possible to go to the sea at reasonable intervals. After spells of intense dryness, it is refreshing and correcting to breathe again damp sea air and smell fresh green grass.

The natives are, generally speaking, healthy; but epidemics of smallpox, typhoid, and influenza periodically occur; they are hard to combat because of the want of sanitation, for which, with the best intentions, it is difficult to make provision where natives are concerned. Malaria is almost unknown, and pulmonary complaints are nearly always traceable to those who have adopted European clothes in exchange for the older native costumes which admitted free air and afforded little protection. Sexual diseases have obtained a firm hold: though medical officers who have rendered admirable service in their free dispensaries report improvement, the hereditary nature of those diseases renders them obstinate of eradication.

Prominent amongst the features most attractive to strangers and travellers is the natural beauty of the country. Small though it be, it is cast in a picturesque mould. The enthusiasm of visitors is justified. To those who, leaving beaten tracks and taking to the wonderful ponies, face the dark mountain barriers, the outlook at first appears most discouraging. It seems almost hopeless to break through those precipitous walls: yet mysterious ways are opened. There is always a way round, and once the heights are attained, marvellous views compensate for the nerve and energy expended. The distant sight of ponies threading their way along minute paths hovering on the brink of precipices with a sheer drop of 1000 feet is a revelation to onlookers. Rarely, however, does an accident happen, and then only when the rider takes the responsibility from his horse. Once only have I witnessed a catastrophe, when an ill-balanced load twisted and disappeared with its pack animal into the abyss below. When the higher ranges of the inner mountains are reached the scenery is inexpressibly beautiful. Miles upon miles of crests, luxurious valleys opening out in all directions, rivers and streams wending their silvery way below, wild chasms, forbidding gorges—these alternate in every day's march. There are, too, some magnificent falls, especially remarkable being those called Malutsenyane, which discharge in the rainy season a gigantic volume of water. They are estimated to be 670 feet high, with a perpendicular drop apparently into the bowels of the earth. The scene below is romantic in character.

Of the rivers it may be said that they are ordinarily shallow, rapid, and clear. With the exception of the Orange or Sinqu, they are in dry weather always low. Under influence of heavy rains tearing down steep gradients they rise with extraordinary rapidity, carrying ruthlessly before them everything living or inanimate which happens to be in their course. To say that walls of water then come down, or that rivers are bank high, is no mere figure of speech. Prevailing features peculiar to Basutoland rivers are treacherous quicksands. To the ignorant traveller they can be veritable death-traps. Their existence limits movements to recognised tracks, and, of course, renders unduly circuitous the routes for wheeled transport.

The fish are disappointing. They consist of what are known as yellow and silver fish, both scaled, and barbel. They afford some sport, but are poor eating. As is commonly known to travellers, eels are not to be found in the South African rivers running from east to west, but flourish in those running the reverse way.

As regards wild game, but little now remains. Government has made an effort to preserve some eland and hartebeest still running in the vicinity of the Giant's Castle, near the steep Natal frontier. A few tigers (*Felis leopardus*) are known to live in wooded kloofs and reed-beds. Jackals and some of the smaller antelopes are found in good numbers; also partridges and mountain hares. Most delightful sport is derived from quail-shooting, which is to be had all through winter. The birds are migratory, but we never could discover whence they come or whither they go. It is comparatively easy to get twenty-five brace in an hour's shooting with pointers through Kaffir corn and mealie stubble. Amongst others who enjoyed our sport during intervals of winter operations were some officers of the Black Watch stationed as garrison of the little border Free State town of Ladybrand. It was a risky job for them riding twelve miles through country more or less occupied by the enemy.

Later on it was quite funny to see the same enthusiasts coming over to Maseru to play the royal and ancient game of golf, with a rifle in saddle-bucket on one side ready for snipers, and a set of golf clubs on the other side. Where they had looted the sticks from was a riddle.

Beyond some thick kloofs lying in folds of the mountains there are few traces of wood, and nothing worthy of the name of timber. In the higher reaches of rivers remain stretches of wide-spreading willows, with occasional wild olive-trees. The question of afforesting is engaging the attention of Government. At seats of magistrates, mission stations, and villages of some chiefs are now to be seen groves of useful trees, mostly eucalyptus and pine.

A good deal of public interest of course centres round the subject of minerals in Basutoland. Like all other unexploited areas, it is commonly supposed to be rich in precious minerals. Coal crops out in several places and is used for local consumption; but it appears to dip irregularly. There are indications of iron, copper, and tin. It has been stated that traces of gold and diamonds have been discovered. I have never discovered a location of either. Government has found it expedient to avoid active research, because of the intense national feeling against it. The Basutos believe that exploitation and discovery of precious minerals have, more than anything else, led to many of the troubles in South Africa, as well as to the political obliteration of those countries in which they were found. They know and often allude to the action of Paul Kruger, who, at one period of his life, made it a penal offence amongst his burghers to announce the existence of payable minerals in the Transvaal. Similarly it is reported of the late paramount chief Letsie that on one occasion when a man found and produced for the chief's inspection a stone believed to be of mineral value, the unfortunate creature was hurled over a precipice, in order that his secret

might perish with him. This object-lesson has to this day deterred others from searching. And so it is that both chiefs and people persistently implored Her Majesty's Government, in pathetic language, to spare their small country from prospectors, urging as their plea that they have been loyal and law-abiding, and will continue to be so. The Government has hitherto respected these prayers, and promised to take them into consideration during good behaviour. At times when a report maliciously circulated by the Boers gained ground that prospecting was to be forcibly permitted, the whole country has been convulsed with alarm amounting almost to madness. During any part of the last sixteen years it is probable that ill-advised attempts to prospect for minerals would have met with armed resistance—perhaps rebellion—so keen is the repugnance of the people to its being done. Even now a mysterious traveller prowling about in quiet places with a kodak is regarded with suspicion and ill-disguised aversion.

A paper of this sort, intended for information, would be incomplete without reference to economic subjects relating to trade, commerce, agriculture, and finance.

It will be a source of satisfaction to many present to know first that all trade is British. The traders are a superior class of men, some of the most enterprising and successful being, as usual, Scotchmen. All merchandise comes from Great Britain, including in transit a small quantity of Belgium blankets, some cheap trinkety things made in Germany, and American ploughs. The amount of dutiable goods imported each year averages about £100,000, valued at coast prices. The total imports are probably double that amount. Exports are approximately of equal value, or in good seasons more. They consist mostly of grain and wool. Basutoland is often styled the granary of South Africa. In the last good season before rinderpest and war dislocated everything, nearly 250,000 bags of grain were sent out. Under favourable circumstances this can always be repeated. The soil is fertile, the people industrious, and every householder a farmer. With a railway brought close to the border, the country could become more than ever of economic value to South Africa in the matter of food supply.

The methods of agriculture, together with too greedy a demand upon the land for continual crops, are offensive features to the scientific farmer. Yet, just as the hoe has given place to the plough, so will other improvements follow. The native can't be hurried. It may be doubted, however, whether a white population on larger holdings would produce nearly the quantity our dusky friends produce from small holdings. In the cropping seasons the country presents the appearance of one huge waving green field of wheat, millet, and mealies, leaving apparently no unemployed arable spaces.

Prominent among stock stand out the Basuto ponies, whose quality is too well known to need description. Short-legged, strong-bodied, and sure-footed, they are seldom sick or sorry, and I rejoice to say that some 15,000 at least have carried our gallant soldiers into action; and if the truth were known I dare say at critical moments many a life has been spared by their nimbleness over difficult ground.

Before rinderpest spread its ravages the land had begun to groan under the weight of vast herds of cattle. It was a nasty time when that deadly epidemic came on its terrible errand, for the superstitions of the natives were roused, and some were so unkind as to attribute the introduction of it to the Resident Commissioner, whose alleged design it was to destroy the cattle and impoverish the land. Any attempt, therefore, to enforce the stamping-out process by shooting would assuredly have resulted in war. Even the system of inoculation discovered by Dr. Koch could only be practised in the most careful way against almost a storm of savage opposition. In the end, by means of exceptional tact displayed by the magistrates, we saved over 50 per cent. of the stock belonging to such chiefs as would tolerate the experiment. At this distance of time we may regard the loss of 50 per cent. as a blessing in disguise to relieve the land of its burden.

A few words as to finance. The only direct tax is 10s. formerly, and now £1, per hut, payable by each man according to the number of his wives. In the first financial year ended 1885, the local revenue, which had perforce to be gingerly collected from those who liked to pay, was £6000. It is now £51,000. There is no public debt, and a comfortable reserve fund has been built up. Few countries are in a more happy financial condition.

I may briefly group here a few items of statistical value derived from the last year's reports. The population is about 270,000, of which 570 are Europeans. Hut tax was paid on 48,029 huts. 1,835,000 lbs. of wool and mohair were exported. There are 140 licensed traders. The number of schools is 177, of scholars 11,134. Expenditure on education, £4358. The native police is 259 strong. There is no white police force. Of 306 criminal cases, the charges were:—Theft, 103; pass laws, 99; liquor laws, 32; homicide, 2; the remainder, assorted offences. Post and telegraph systems extend through the country. Letters from England take 23 days in transit. The volume of letters, cards, papers, and parcels last year aggregated 340,000 items. Before the war good ponies were obtainable for £5. They are now up to £30. The average value of wheat to the producer is 10s. per bag of 205 lbs. The average rainfall is 35 inches.

As regards education, I can have no hesitation in expressing the conviction that it has contributed largely to the contentment, enlightenment, and prosperity of the people. Though Government exercises a watchful and controlling hand over it, particularly dealing with and encouraging technical training, the actual work is committed to and undertaken principally by various missions, whose united object is to earn and administer grants in aid. More especially have the members of the French Protestant Society—amongst whom are several Scotch men and women—lent themselves to the work of education in a wholesome way. They have been identified closely with the history and destinies of the tribe for over fifty years with credit to themselves and advantage to the country. No necessity for an expensive Education Department has yet arisen. Meanwhile the missionaries are fulfilling an important service by combining religious work with school teaching.

The indiscriminate deductions often drawn by the public from unfortunate mistakes of a few educated natives or Christian converts are singularly unfair; but it is quite true, as so many urge, that an educated boy does not give his attention to kettle-cooking and cattle-herding so assiduously as a raw barbarian. To give an education which is in advance of their condition is in my opinion an unfortunate mistake: for the sphere of work opened to advanced scholars is infinitely small. Nothing is more cruel than to give boys high learning and turn them adrift. They soon get discouraged and desperate. The next process is lapsing or crime—sometimes both.

The natives are practically abandoning their old religions and adopting ours. Bearing in mind that they are still in the stage of infancy, it is only remarkable that so few do err. That the influence of Christianity and education upon native character is sound, in enabling them the better to understand the meaning of honesty and to distinguish right from wrong, I profoundly believe.

In alluding to the absorbing question of liquor, I feel on common ground with many people in England and the Colonies who are rightly averse to natives getting it. By the Regulations of Basutoland, the introduction of spirituous liquor in any form is prohibited without permit, and no permit is granted to natives unless for medical quantities under medical certificate. I can hardly describe the depraved state of Basutoland when we entered it in 1884. Scarcely any villages were immune from the ravages of brandy—bad, fiery, poisonous stuff warmed up with hideous concoctions to make it tickle the throat as it was gulped down. Political work amongst the chiefs was then a risky undertaking. A magistrate on duty at a chief's village was liable to insult and violence. The people were becoming besotted. Some of the leading men, and even women, fell a prey to the poison, beggaring themselves to acquire it. In 1886 a crusade against it began. Gradually the evil was overcome, not, however, without many struggles, in one of which the present writer was near being roughly handled for spiking a barrel from which a low Boer was retailing the stuff on half-profits with the chief. The missionaries and traders lent assistance to a great effort of Government, by which combination of forces canteens were driven out headlong, leaving us to reckon with a nefarious over-border traffic which has continued to this day, though in modified degree. This traffic was carried on by low-class whites of Dutch extraction, commonly called Bijwooners, who, having no land of their own and being too lazy and indifferent to labour at respectable trades, sought to eke out existence on the profits of illicit dealing. Our efforts to gain help from the Free State Government and its landdrosts in crushing this traffic were always vain. The Free State laws were good in principle, but inoperative and imperfect. For instance, it was criminal by law to sell to a native; but since it was not punishable for a native to buy or be in possession, the canteen keeper had only to square the police to shut their eyes during the process of sale. Of evidence we produced abundance, but could never get convictions, primarily because the landdrosts were afraid of the burghers who could vote them out of office, and incidentally because the evidence of black men alone was not deemed sufficient to convict a Boer.

It is fairly certain that the Kaffir races are too prolific to be killed off by brandy-poisoning as has happened to aboriginals in other parts of the world. It is quite certain that free use of brandy is degrading and degenerating. I venture to hope that the efforts of those in England and the Colonies whose aim it is to enlist the support of Government in prohibiting sale of liquor in any form to natives will be successful.

Now that the Orange Free State has been incorporated, the evils from which Basutoland has so long suffered are at least capable of remedy. Co-operation by the natives may be looked for, because the taste for drinking spirits is of too modern growth to be seriously hereditary. It has been acquired rapidly, and when opportunity ceases to exist the craving may as rapidly disappear.

Connected in some degree with the liquor traffic is the matter of border relations between black and white, which some thinkers hold are likely to be strained in future more than in the past, in view of the feeling that the new order of things in South Africa is calculated to breed Kaffir insolence.

Heretofore the most prolific source of crime and ill-feeling was theft of stock. These thefts were frequently committed by men who were in search of liquor or used that object as an excuse for stealing expeditions. There seems some irresistible force impelling natives to steal cattle. Risk of imprisonment, lashing, and fines do not greatly deter them. Men even of responsibility, with much to lose, occasionally abandon themselves to it. Wealth in cattle and sheep is to them wealth indeed. They have not yet learned to confide in savings banks, believing, like many ignorant Boers, that any concern which takes care of your money and pays you interest for the trouble *must* be shaky. As yet, something less than one thousand only out of a population of a quarter of a million have ventured to make deposits in savings banks, which are made available at every seat of magistracy. Generally speaking, border chiefs and Boer farmers endeavoured always to be on friendly relations for mutual reasons. An informal league between them helped to depreciate the influence of Government, which in some ways was distasteful to the independent ideas of both. Boers preferred to deal directly with chiefs, ignoring British rule; and chiefs liked to enjoy the freedom of crossing the frontiers without passes, in contravention of regulations. Any farmer who paid wages honestly and did not defraud the workman at the end of his term had no difficulty in getting a requisite amount of labour, and was more immune from stealing. But the men who tried to rob the Kaffir of his earnings had a very poor time afterwards. They used to come wailing to us after having failed to get redress from the chiefs, with whom they first coquetted, but received a cold shoulder from the magistrates unless they first produced the withheld wages.

Closely allied to border relations stands the matter of native police, to which, interesting though it be, want of space forbids any lengthy allusion. The police are recruited by Government from within the tribe, by selection as far as practicable from each chief's ward, by which means every village and person becomes known and traceable in the magistrate's court. The force is most economical, each recruit receiving

£2 a month and providing his own horse and food. The men are contented and happy, performing excellent service without display. It is no rare thing for a single policeman with a cane in his hand to arrest and lead a string of law-breakers quietly to the magistrate. Controlled by officers whom they respect and by whom they are known, they will be led anywhere and do anything in reason with intelligence. Their patrolage along the border during the first year of this war aggregated 100,000 miles. As a recruiting ground for permanent native forces, it may be of value. Whether the men would agree to serve beyond sea there has never been occasion yet to inquire.

So many engaging topics present themselves that my embarrassment has been to know which to pass over. Still I hope to have travelled over most of the profitable ground, and may be allowed to end this paper with some general conclusions.

It would be idle to pretend that a country built upon violence, ruled despotically by a savage chief for years, surrounded by enemies, frequently at war, and governed intermittently at the caprice of political parties, could settle into a prolonged state of peace without struggles, and expenditure of thought and energy, on the part of those responsible for its affairs.

Standing out of course pre-eminently in supreme prominence is the Colonial Office in England, which, though at times it must have been perplexed when dangers of war and threatened complications jostled each other along the road to Downing Street, still stuck gamely to the child of its creation—the only one of its genus in South Africa. The new Basutoland was a courageous experiment, requiring for success, patience, sympathy, and consistency. After a long and continuous experience in the country, helping to work out its destiny, I may be allowed to attest from knowledge how well and truly patience, sympathy, and consistency were extended to us by the Colonial Office. Many times when sections of the public were screaming for what was called "subjection of the Basutos," those to whom we were responsible declined to be enchanted, hoping and believing there was some way of combating grave difficulties without recourse to methods of assault and battery. No doubt the risks of an expensive war were always in the balance. Yet it has always been apparent that the policy was governed by high principle and determination not to shrink from the experiment designedly undertaken.

No clearer illustration is needed of the influence over savages to be gained by firm consistency than the present war has afforded. We may lay aside any hopeful ideas that untutored nations love us in the ordinary sense. I cannot cherish the belief that any natives like to be forced to change their wild habits and customs, which are more attractive to them and offer lines of easier resistance. What we have to look for in them is respect—not the respect maintained by drumming and thrashing—but in a higher sense that which follows from fair and just treatment. Having forced them to abandon barbarism we are responsible for their guidance.

When the present war broke out, the Basutos, who were regarded

with some awe by other tribes, pledged their opinion and belief that the armies of the great Queen would soon overcome those who had recklessly declared war. It was then that they offered themselves, claiming the privilege as loyal servants to be allowed to fight alongside the Queen's soldiers. I need not say more than that all such propositions met with unqualified disapproval and refusal. It was with reluctance that we consented to mobilise forces for home defence when Maseru was threatened and demonstrations elsewhere became necessary. It is so easy to set savage forces in motion and so hard to control them afterwards. As unarmed scouts and purveyors of intelligence from all sides for which the army was so hungry they could fairly be employed and performed excellent service.

At the siege of Wepener we had 7000 Basutos almost alongside the Boers who were investing it for several days. They did want to cut in, no doubt, but remained under perfect discipline, admiring the pluck of our garrison, and cheering when our shells found a good target.

Similarly when other British garrisons were surrounded, or fighting raged along the river border, our people displayed the keenest anxiety, affording us from different points of view valuable information of the enemy's movements, which we were able to place rapidly at disposal of the commander-in-chief and generals in command of local operations. And if small bodies of our troops, or refugees, were cut off, they often plunged into the river and made for the nearest native village, where they were hospitably treated and escorted to one of our nearest magistrates.

But there came dark days when the outlook was of the gloomiest; the gloom was not confined to England. It entered deep into the souls of the natives, who feared that Dutch ascendency was coming and that a day of reckoning would follow for their loyalty. Very sound reasons existed for those fears. No exception could be taken to them. Words were of little avail: it was a moment rather for silence and dogged confidence. If the tide had not soon turned it is doubtful what might have happened. Had fear gained the mastery and been followed by impulse, those passions might have been let loose which British officers had been set the task of curbing. Happily at Paardeberg the tide turned strongly, and with it partially vanished the odious risk of native intervention. The subject furnishes a story of great interest into which I cannot now enter. But I am glad of this public opportunity to pay a tribute to those whose united efforts and influence held effective sway at a critical time. I refer to the magistrates in Basutoland. Gentlemen of birth and education, some home born, some Colonial, they combined, as stated in my Annual Report, judicious energy with tact, and discharged a great trust with deserving and signal success.

And this leads me, without being rash enough to prophesy, to some aspects of the future, the enduring success of which depends so much upon continuity of administration.

Rapid improvements are not to be looked for; they are rather to be deprecated. Comparisons are better sought after ten years than one, and then simple movements may be traced. Though the social condition

of the Basutos, according to European ideas, leaves much to be desired, any attempt to introduce radical changes would probably defeat its object and be interpreted as a design to abolish their cherished customs and institutions, now more harmless than vicious. Lurking behind the veneer to which the wearing of smart clothes gives an appearance of civilisation there is a lingering superstition that will take generations to eradicate. The people have in fifty years emerged from savagery and are now on the threshold—not of civilisation but of enlightenment. There they had best dwell for a time.

Meanwhile, are they fulfilling any definite purposes of betterment to themselves and of benefit to the dominion? They certainly are. First, as producers of a large food supply, and secondly, as a source of personal contribution to the great labour market. The advantages are of course mutual. In published returns for the year before the war it may be seen that, out of an adult population of 50,000 men, 37,000 voluntarily went away in search of labour at mines, farms, or domestic service. The figures are almost eloquent of enterprise and industry.

The land question in Basutoland a few years ago began to assume the proportions of a problem. The soil was then nearly all taken up by permanent occupiers: the surplus population was getting squeezed out. Demand for labour offered a solution when the Transvaal goldfields were discovered and changed the order of South African life. Into the genesis of the desire by natives to work, the methods by which that desire may be stimulated, and the kindred question of the future labour supply, it is not expedient in this paper to enter. Wide issues depend upon it in which Basutoland becomes but a fragment.

In taking leave of the Basutos, let me recall what has often been said of them, viz., that they are their own worst enemies. The ungovernable ambition of wild young chiefs, together with tribal disputes and jealousies, which have so many times plunged them into disorder, may do so again; for their family animosities are keen, and the present paramount chief owes his position absolutely to the moral support of Government against the intrigues of his relations. He and his sons are inclined to forget from whom that support, and the power it conferred, were derived. Though prone to drink spirits freely if obtainable, and to make deceit a part of his daily life, he has ability to deal with work in a businesslike way, and unusual resolution in acting upon orders and advice essential to the safety and welfare of the tribe.

His eldest son and heir is of poor intellect with decidedly vicious tendencies. The history of intrigues and various crises arising from them in recent years would afford materials for an exciting story. The serious point is that repeated tumults in a protected territory cannot of course be tolerated, because of their menace to the common peace. It is from that danger they have most to fear as a cause for withdrawing the privileges His Majesty's Government has hitherto felt at liberty to extend to them.

RAILWAY SCHEMES IN RELATION TO BRITISH CENTRAL AFRICA.

By S. H. F. Capenny.

British Central Africa is the general designation for British territory between the Zambezi and Tanganyika. It borders, from east to west, with the territories of Portuguese East Africa, German East Africa, the Congo State, Angola or Portuguese West Africa, and German South-West Africa. The border-line on the west has not been delimited locally, but is determined in principle according to the limits of Marotseland. This territory is officially divided into the British Central Africa Protectorate and North Rhodesia, which last is subdivided into North-Eastern Rhodesia and North-Western Rhodesia. But British Central Africa is in common use as a name for the British Central Africa Protectorate alone, which was formerly called Nyasaland. This name is still occasionally used, but notification was made on February 22, 1893, that the protectorate over the Nyasaland districts was to be officially known and described as the British Central Africa Protectorate. It is well to know and keep in mind that the eastern half of British Central Africa, east of the Kafue river, has been mainly connected in the past with Zanzibar and the northern half of Portuguese East Africa, and that the western half or Marotseland belongs historically, as it now belongs politically, to British South Africa.[1]

Most of this vast territory falls within the basin of the Zambezi. As soon as it began to be opened up to civilisation and commerce the desire was awakened to develop a highway of trade from the coast along the inland waterways of the Zambezi and the Lakes to Central Africa. This enterprise, however, was attended with many drawbacks. Notwithstanding the several breaks in the line of communication, the most formidable difficulty was the navigation at the mouth of the Zambezi. At first the most feasible channel was considered to be the Kongoni mouth, but such was the uncertainty, amounting to impracticability, that the African Lakes Company had almost abandoned this way into the Zambezi. In that event there would have been a choice of two routes to Lake Nyasa, the one overland from the Zanzibar coast, the other by way of Quilimane. The former had many to support it as an established caravan highway. Quilimane, however, was considered the gateway to Nyasaland, and was the headquarters of the Zambezi trade. The trade between Quilimane and the Zambezi goes by way of Mopea, which is nearly three miles from the left bank of the Zambezi. It is some eighty miles from Quilimane, on the Quaqua branch of the Quilimane river. In the dry season the boats are unloaded at Marendene, a few miles below Mopea, where there is deeper water in the river. Thence the goods are conveyed by porters to the banks of the

[1] *British Central Africa*, by Sir Harry H. Johnston, K.C.B., London, 1897, p. 78.

Zambezi, a distance of six miles, either to Mazaro or to Vicente, four miles above Mazaro. The transport from Quilimane to the Zambezi occupies from three to five days. When the African Lakes Company made use of this route they had a station at Maruro, just below Mazaro, some five miles from Marendene. The site was purchased by the Company in 1882, but most of it was washed away in 1883-84. When the African Lakes Company was about to adopt this route and give up that by the Kongoni, it amounted practically to a recognition that no direct connection was feasible between the shipping of the ocean and the river.

These and other drawbacks to the navigation of the Zambezi had an important effect politically as well as commercially. It was this consideration of the difficulties of access that made the British Government hesitate about asserting British claims in Central Africa and proclaiming a protectorate over the Nyasaland districts. "At this juncture," says Sir Harry Johnston, "a discovery of the greatest importance was made, which completely altered the political aspect of the question. Mr. Daniel J. Rankin, an explorer who had originally proceeded to Nyasaland as private secretary to Consul Foot, and who had also acted in a Consular capacity at Moçambique, was enabled by the Royal Scottish Geographical Society to institute an exploration of the Zambezi delta. In the course of his journey he discovered the Chinde mouth of the Zambezi, which apparently was quite unknown to the Portuguese Government, though it had probably been first discovered by a Portuguese planter who was working a concession in the delta. This planter's information put Mr. Rankin on the track of his discovery, which he announced to the world in the spring of 1889. It was briefly this, that the Chinde mouth of the Zambezi possessed a bar shorter and safer and simpler than that of any other outlet of the Zambezi, and with a minimum depth of water at high tide of 17 feet (as against, say, 10 feet at the Kongoni). At the time Mr. Rankin sounded the bar, I believe he found a depth of water on it of 21 or 22 feet, a depth which has several times since been recorded, but chiefly at that season of the year when the river was visited by Mr. Rankin, namely when the Zambezi is in full flood. Ordinarily the depth of water at high spring-tide is 17 to 19 feet. Not only was the Chinde bar a far less serious obstacle than that of any other mouth of the Zambezi, but its channel from the sea into the main Zambezi was easier of navigation than the other branches of that river. In its far-reaching political importance, probably no greater discovery in the history of British Central Africa has been made than that of the navigability of the Chinde river from the Indian Ocean to the main Zambezi."[1] Sir Harry Johnston himself was one of the first to proceed to Nyasaland by the Chinde route. Soon after he arrived at

[1] *British Central Africa*, p. 79. On the Zambezi and Chinde route to British Central Africa, see papers by Mr. F. L. M. Moir on "Eastern Route to Central Africa," *S.G.M.*, April 1885; by Commander H. J. Keane on "An East African Waterway," *S.G.M.*, March 1895; by Mr. D. J. Rankin on "The Zambezi Delta," *S.G.M.*, September 1889; and on "The Prospects and Commercial Prospects of the Zambezi Basin," *S.G.M.*, May 1893.

Mozambique from England in 1889 there arrived H.M.S. *Stork*, a surveying vessel, which had just returned from Chinde, where it had been sent to verify Mr. Rankin's discoveries. The commander reported that he had passed up into the Zambezi in his steam-launch, and had found the channel all the way deep enough for even the *Stork* herself, whose draught was 13½ feet. Sir Harry Johnston thereupon obtained permission from the Government to use the *Stork* for the conveyance of his expedition. On the 28th of July 1889 the *Stork* crossed the bar of the Chinde mouth without difficulty, and steamed up the Chinde river into the main Zambezi.[1]

The port of Chinde is now the chief *entrepôt* for British Central Africa, the Zambezi, and the Lake districts. Its population in 1899,[2] Europeans and natives, resident at Chinde, and working on the steamers, amounted to 1245, of whom 78 were British, 42 Portuguese, 7 Germans, 54 Indians (chiefly British), 19 Zanzibari, 545 Portuguese natives, and about 500 British natives. The Portuguese settlement of Chinde is established on Foot point, and the British Concession, as the piece of land (some 25 acres) leased in 1892 is called, adjoins it on the west. The British Concession has had a river frontage of 437 yards, and extends across to the shore of the ocean. The river shore, however, has been much washed away, and the New British Concession has been granted to replace the land lost on the Old Concession by the encroachment of the river. The seaward portion of the Concession is allotted to British trading-companies, where they have offices and wharves. Besides the British Vice-Consulate, there is now a good hotel kept by a Scotsman. The British Concession is regarded for postal purposes as part of the British Central Africa Protectorate. Chinde is connected by telegraph line with Quilimane through Sombo, which is twelve miles above Foot point, with Sena and Tete, and with Chiromo, Chikwawa, and the British Central Africa Protectorate. Chinde is comparatively healthy, and a short stay there frequently benefits people who have suffered from malarial fever in the interior, and on arriving at Chinde there enjoy a bracing sea-breeze.

The Chinde[3] river is about twenty miles in length from its entrance to its junction with the Zambezi. Between Foot point, which is the south point of the entrance, and Mitaone, its north point, the river is about 7 cables, or 1400 yards, wide. The Chinde is tidal throughout. At all states of the tide there is sufficient depth for a vessel within the bar to ascend to one mile above Sombo. There the river is about one cable, or 600 feet, wide: but above Sombo the river is much narrower, and the depths are only from 6 to 8 feet at low-water in some places: at its junction with the Zambezi the bar has from 8 to 10 feet at low-water. Vessels of about 150 feet in length once committed to the upper part of the Chinde, which is some 200 feet wide, must continue on into the Zambezi as there is no room to turn.

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[1] Sir Harry Johnston's *British Central Africa*, p. 82.

[2] *Foreign Office Report on the Trade of Chinde for* 1899 (Annual Series, No. 2495), p. 10.

[3] *Africa Pilot*, Part III., pp. 227-276.

The navigation of the Zambezi, as in most of the rivers of Africa, is obstructed by rapids and falls, as determined by the structure of the continent. It is also a river subject to great fluctuations of depth. During the rainy season it floods, the water rising from 15 to 20 feet, sweeping down with great rapidity and filling all the valley. At the height of the dry season it is reduced to channels of water winding between dry sandbanks, with here and there shallows, which even a draught of 18 inches can hardly pass. The channel of one year, or at times even of one week, becomes a bank the next, and there is no permanence in either direction or depth of the navigable passages. The head of navigation on the Zambezi from Chinde is at Tete, 300 miles from Chinde, or at the rapids 20 miles beyond Tete; on the Shire it is at Chiromo, Katunga, or Chikwawa, which is also some 300 miles from Chinde. The navigation is easy during the rainy season, when the river is in flood from January to April on the Zambezi, and from January to July on the Shire. It may be said in a general way that vessels of 18 inches' draught can navigate to the rapids above Tete, and to the Murchison Falls at all seasons of the year. The river steamers are most of them flat-bottomed stern-wheelers, drawing from 12 to 24 inches of water; the latest and most approved are 85 feet long by 18 feet beam by 3 feet deep, with draught of 16 to 24 inches, according to amount of cargo and number of passengers. Each has accommodation for twenty passengers, can carry twenty tons of cargo, and can tow two barges (carrying about twenty tons each), which are attached to hug the steamer, one on either side.

The trade of Chinde is chiefly a transit trade. Goods are transhipped either at Durban, Lorenço Marques, Beira, or Moçambique. The cabotage or coasting trade from these ports connects with the canotage or inland river and lake traffic at Chinde, where goods in transit for Central Africa may be landed and reshipped free from Customs duties. The amount of goods carried by the transport companies during the year 1899 amounted to 15,226 tons. The African Lakes Corporation carried 5390 tons, of which 2500 tons were imports to British Central Africa and 350 tons exports therefrom, and 2460 tons were imports to Portuguese ports and 80 tons exports therefrom. Sharrer's Zambezi Traffic Company carried 3715 tons, of which 2800 tons were imports to British Central Africa and 615 tons exports therefrom, and 200 tons imports and 100 tons exports to and from Portuguese ports. The African International Flotilla and Transport Company carried 5767 tons, of which 1679 tons were British Central Africa imports and 207 tons exports, and 1870 tons of Portuguese imports and 2011 exports. The British Central Africa Transit Company carried 354 tons, 220 tons of British imports and 58 tons of exports; 57 tons of Portuguese imports and 19 tons exports.

In order to show how wide the field of trade is for which the port of Chinde is the gateway, it is but necessary to give a list of the stations of these commercial companies. The chief stations of the African Lakes Corporation are Chinde, Port Herald, Misanji, Chiromo, and Katunga (or Port Blantyre) on the Lower Shire; Mandala (near Blantyre, their

chief office in Africa) and Zomba in the Shire Highlands; Fort Johnston in South Nyasa, Bandawe and Kota-Kota in West Nyasa, and Karonga in North Nyasa: Fife between Nyasa and Tanganyika; Kituta on Tanganyika: and Chienji on Lake Mweru. Sharrer's Zambezi Traffic Company has stations at Chinde, Port Herald, Chiromo, Masingosa, Maparere, and Katunga on the Lower Shire; Gwaza (Mpimbi) on the Upper Shire; and Fort Johnston. The African International Flotilla and Transport Company has stations at Chinde (their head office in Africa), Tete, Chiromo, Makwira (port for Cholo district), Patima (or Katunga), Blantyre, Mpimbi, Fort Johnston, Kota-Kota, Bandawe, Likoma, Nkata Bay, Wiedhaven, Amelia Bay, Deep Bay, Florence Bay, Karonga, Kambwe Lagoon, and Langenburg on Lake Nyasa; Ikawa (or Fife) between Nyasa and Tanganyika; Abercorn near Tanganyika, and Kituta.

In his Report on the trade of Chinde for 1899, which was received at the Foreign Office in July, and published in August 1900, Mr. Vice-Consul Errol MacDonell gives a return of the number and carrying capacity of steamers, barges, etc., on the Zambezi and Shire rivers on December 31, 1899. The African Lakes Corporation had five stern-wheel steamers (passenger and cargo), one steam tug, thirty-six barges, making a total of forty-two vessels, the steamers having a carrying capacity of 250 tons, and the barges 850 tons, making a total of 1100 tons. This company had two steamers and four barges in course of construction. Sharrer's Zambezi Traffic Company had two stern-wheel passenger and cargo steamers, two steam launches, and twenty-eight barges, making in all thirty-two vessels, the steamers having a carrying capacity of 75 tons, and the barges 885 tons, making a total of 960 tons. This company had in course of construction two steamers and four barges. The African International Flotilla and Transport Company had three stern-wheel steamers and seventeen barges, with a carrying capacity of 105 and 505 tons; and had two steamers and four barges constructing. These are the chief trading companies.

The services of the African Lakes Corporation, regarding which most details are at hand, are divided into five sections. On the Zambezi and Lower Shire section this company has the stern-wheel steamers *Empress*, *Princess*, *Duchess*, *Sir Harry Johnston*, *Bruce*, *Scott*, and the side-paddle steamer *Henry Henderson*. These vessels run in connection with the Coast or Ocean Mail Boats, and leave Chinde weekly for Chiromo or Katunga, carrying mails, passengers, and cargo for British Central Africa, North-Eastern Rhodesia, and the Congo Free State. On the Upper Shire section there are the stern-wheel steamer *Monteith* and the twin-screw steamer *Livingstonia*, which leave Matope weekly for Fort Johnston. On the Lake Nyasa section there are the screw steamers *Queen Victoria* and *Domira*, which sail from Fort Johnston for the north end of Lake Nyasa, calling at the several ports on the lake: Monkey Bay, Cape Maclear, Domira Bay (for Mvera), Fort Maguire, Kota-Kota, Bandawe, Likoma, Florence Bay (for Livingstonia), Deep Bay, Karonga, and Langenburg. On Lake Tanganyika section there is the screw steamer *Good News*, which sails every ten days from Kituta for the north

end of Lake Tanganyika, calling at Sumbu in British territory, going north and coming south, at Albertville, at Ujiji, and other ports of the Congo Free State and German East Africa. On the Lake Mweru section is the steam launch *Scotia*, which sails from Chienji for Lake Mweru ports and up the Luapula river as far as the Johnston Falls.

It will be seen that between the several sections of this system of canotage there intervene two breaks between Chinde and Lake Tanganyika, and three breaks between Chinde and Lake Mweru, as Chiromo or Katunga, according to season, is the head of navigation on the Zambezi and Shire. From Katunga passengers are conveyed overland by *machila*, mule-cart, or ricksha to Blantyre, Zomba, Chiradzulu, or other points in the Shire Highlands, and to Matope, one of the ports on the Upper Shire. From Katunga there is a made road to Blantyre and Zomba, from Blantyre to Matope and Mpimbi, and from Zomba to Liwonde. Besides the vessels of the African Lakes Corporation there is on the Upper Shire the ss. *Stairs* of the African International Flotilla and Transport Company, which leaves Mpimbi every Monday at daybreak, and returns from Fort Johnston every Wednesday at daybreak: and there is also the ss. *John Bowie*, which sails from Gwaza (Mpimbi) at daybreak every Wednesday. The second break is between Lake Nyasa and Lake Tanganyika: passengers land at Karonga, at the north end of Lake Nyasa, and proceed by the Stevenson Road to Fife and on to Kituta; the means of conveyance are ox-wagons, pack-donkeys, and native carriers—by *machila* and native carriers, tents and complete camp equipment being provided by the transport company. The third break is between Lake Tanganyika and Lake Mweru, whither passengers go overland to Chienji.

If, then, a person leaves England for Central Africa, he may proceed from London to Chinde either by way of the Cape or overland to Naples and thence by the Red Sea. In either case he will probably change from his ocean liner to a coasting steamer at one of the chief East or South Africa ports, which will convey him to Chinde. The first-class fares to Chinde range from £45 to 50 guineas; the second-class from £32, 10s. to 35 guineas. From Chinde he will proceed up the Zambezi and Shire in one of the light-draught river steamers to Chiromo or Katunga, and thence to the Shire Highlands or the Upper Shire. The fare from Chinde to Chiromo is £7; to Katunga £9; to Mandala and Blantyre £11. From Blantyre to Fort Johnston he will go by road to Matope and thence by the Upper Shire service to Fort Johnston. The fare is £6. On his return to Chinde the fare from Katunga to Chiromo is £2, and from Katunga to Chinde £6. The freight from Chinde to Chiromo is £3, 10s. a ton: to Katunga £5; to Mandala and Blantyre £7: from Mandala to Fort Johnston £5. From Katunga to Chiromo or Chinde the freight is less by 25 per cent., and special rates are quoted on coffee consignments to the coast.

The above rates of fares and freights were received from the Secretary of the African Lakes Corporation in January of this year. The following are derived from the tariff book of fares (1899) of Sharrer's Zambezi Traffic Company. The first list gives the passenger fares between

Chinde and Portuguese ports, the second from Chinde to British Central Africa ports. From Chinde the fare to Vicente (first-class with food, including the use of "bedding, linen, and good table") is £2, 10s.; to Shupanga £3; to Misongwe £3, 10s.; to Morambala £4; to Muterare £6; to Sena £7; to Tete £10; from these ports to Chinde the fares are £8, £5, £4, £2, 10s., £2, £1, 15s., £1, 10s. respectively. The fares from Chinde to British Central Africa ports are—to Port Herald £6; to Chiromo £7; to Masingosa £8; to Maparere, Katunga, or Chikwawa £9; to Blantyre £12; to Zomba £13; to Mlanje £13; to Mpimbi £13; to Fort Sharpe £14; to Fort Johnston £16; from these several ports to Chinde the fares are—£12 (Fort Johnston), £11 (Fort Sharpe), £10 (Mpimbi, Mlanje, and Zomba), £9 (Blantyre), £7 (Chikwawa, Katunga, and Maparere), £5 (Chiromo), £4 (Port Herald).

The rates of freight received from the Secretary of Sharrer's Zambezi Traffic Company in May 1899 were from Chinde to Fort Johnston £12 a ton; from Fort Johnston to Karonga £10 a ton; and from Karonga to Kituta £30 a ton.

In order to compare these fares and freights by canotage and porterage with the rates by railway in that part of Africa, the following are the fares, freights, and distances on the Beira and Mashonaland Railway as given in Mr. Consul Belcher's Report on the trade of Beira and district for 1900 (Foreign Office, June 1901, Annual Series, No. 2627). The fares on the Beira and Mashonaland Railway are at the rate of 4½d., 3d., and 1½d. for first, second, and third class respectively. From Beira to Fontesvilla, 40 miles, the fares are 14s., 10s., and 5s.; to Bamboo Creek, 70 miles, £1, 3s., 16s., and 8s.; to Mandegas, 130 miles, £2, 7s., £1, 12s., and 16s.; to Maçequçe (or Massikessi), 190 miles, £3, 9s., £2, 6s., and £1, 3s.; to Umtali, 210 miles, £3, 15s.. £2, 11s. 6d., and £1, 5s. 6d.; to Salisbury, 375 miles, £7, £4, 14s., and £2, 7s. From Umtali to Salisbury, 165 miles, the fares are £3, 5s., £2, 2s. 6d., and £1, 1s. 6d. For rates of freight goods are classified into three classes: in the first the freight is 10d. per ton per mile, plus 5s. per ton; in the second 8d. per ton per mile, plus 5s. per ton; and in the third 6d. per ton per mile, plus 5s. per ton.

The trade of Chinde, it has been said, is chiefly a transit trade with the Zambezi, British Central Africa, and Lake districts. The trade of the British Central Africa Protectorate amounted to £250,000 in 1899-1900. At Port Herald the imports amounted to £3,729, 13s. 11d.; at Chiromo, £154,305, 3s. 5d. The exports from Port Herald amounted to £834, 14s. 2d.; from Chiromo £98,514, 8s. 9d. There were, besides, goods in transit passing through the Protectorate to the amount of £31,337, 4s. 6d. The chief exports were 1100 tons of coffee, estimated at £62,223, 2s. 9d.; rubber to the amount of £13,189, and in addition a considerable amount in transit; ivory, £2328, 14s., and a considerable amount in transit; tobacco, £112, 14s. 10d.; 19,000 lbs. of chillies, £84, 15s.; beeswax, oil-seeds, and strephanthus. During the year the channels of the Zambezi and Shire were navigable from Chinde to Chiromo all the year, and small steamers had little difficulty in taking

barges up to Katunga. The mails for the Protectorate are, as a rule, brought by river to Chikwawa during February, March, April, and May, when the navigation of the Shire above Chiromo is usually practicable for the larger class of steamers. From Chikwawa the mails are conveyed to Blantyre and Zomba by road in about 10 and 24 hours respectively. From June to January the mails are taken by water to Chiromo, and thence carried overland in about 2 days to Blantyre and 2½ days to Zomba. The incoming home mails usually reach Blantyre about 10 days after the arrival of the ocean steamers at Chinde.[1]

Here then is a highway of communication from Chinde which has become the commercial artery of the heart of Africa. By way of it there is an increasing trade between the coast and the districts of the British Central Africa Protectorate and of North-Eastern Rhodesia, as well as of the German territories on Lake Nyasa and Lake Tanganyika, and of the eastern parts of the Congo Free State, Germans and Belgians alike making use of this route in proceeding to their respective territories. It would seem, therefore, that the early hopes have been realised, and that the commercial supremacy in Central Africa has been secured for this Britannic highway. But it is now beginning to be found that the success with which this commercial highway has been developed has been at the cost of the prosperity of the Shire Highlands, which is the chief part of British Central Africa, and best fitted for residence if not colonisation. It is found to be to the detriment of the Shire Highlands, since the demand for porters deprives the planters of their native workers. "At the present time," says Mr. Sharpe in his Report for 1899-1900, "almost the whole of the available labour-supply, which should be employed in planting and other operations, is occupied carrying loads from the navigable Shire river to Blantyre, the Shire Highlands, and to the Upper Shire river. Transport work has so very largely increased that it is probable that during the current year the whole supply of labour will not be sufficient to cope with even the transport question. Natives prefer transport work to any other, as they can more quickly and easily earn money by this means. I consider that the British Central Africa Protectorate has now almost reached its limit of production and export unless a railway is constructed from Chiromo to Blantyre. This would set free for ordinary plantation work the many thousands of natives now occupied in transporting loads on their heads." It is reported that in November last no less than 100,000 loads were lying at Katunga, some of which had remained there for over a year.

That native porters are needed for this work arises from the fact that the road from Katunga to Blantyre, which is some 28 miles, is too steep for wheeled traffic. Katunga is some 300 feet, and Blantyre some 3200 or 3400 feet above the sea, and there is a rise of nearly 3000 feet in 12 to 14 miles. A wagon road was commenced by Sir Harry Johnston to lead from Chiromo, by way of the Tuchila river, to Blantyre and Zomba, but it was not completed. Mr. Sharpe, however, is

[1] *Report on British Central Africa Protectorate for* 1899-1900. By Mr. Commissioner Sharpe. Annual Series, No. 2497.

alive to the feasibility of this carrossable route. "The question of a Shire Highland trunk road," he says, "commencing at Chiromo and running through the Cholo district to Blantyre, is now under consideration. Such a road would be used entirely for wheeled traffic, and not by carriers. So long as the Shire river keeps up its present high level, it is improbable that the proposed road would be much used; but the experience gained some years ago of really bad seasons, when navigation beyond Chiromo was rendered quite impossible, suggests the desirability of taking this route in hand in good time." This wagon road was designed to connect Chiromo with Blantyre, Zomba, and Mlanje. Starting from Chiromo, it would follow the Ruo to its junction with the Tuchila, whence the branch road, with a ferry or bridge across the Tuchila, would follow up the Ruo valley to Fort Anderson and Fort Lister for behoof of the Mlanje district. The Blantyre road would proceed from this junction along the right bank of the Tuchila and the valley of its western affluent, the Swadzi. The road to Zomba branches off a little beyond the Midima hills. The chief reason for the choice of this route was the desire to escape as much as possible the districts still infested with the tsetse fly, and to make it serve several districts. It was hoped that it would be an important artery for traffic: but in his Report of 1894 Sir Harry Johnston's final remark anent roads was, "I fear the only certain and practical way of opening up communication with this country will be a railway between the Lower and the Upper Shire."

A railway is the thing that is needed and has been desiderated. That was a decision speedily arrived at by those most concerned in the economic prosperity of British Central Africa, and there is now a decided feeling among them that the construction of a railway cannot well be longer delayed. Now that the increase of trade is such that the commercial companies are hardly able to cope with its demands, a railway has become vitally necessary, in order that the success of this commercial highway may be maintained, and that the many thousands of natives may be liberated from the carrying trade, and become available for the development of the economic possibilities of the country. It is estimated that probably as many as 80,000 are at present required annually as porters.[1]

Several schemes have been proposed, and several surveys made. A company was formed in 1895 to build a railway through the Shire Highlands from Maparere between Chiromo and Katunga to Mpimbi. In 1895-96 a survey was made of a route by Mr. Grieve Macrone, C.E., on behalf of another company. The route which he deemed the most feasible started from Chiromo, and proceeded by way of the Ruo, Tuchilo, and Luchenza valleys to Blantyre, whence it proceeded to the Upper Shire, and terminated a little below Mpimbi. From Chiromo to Blantyre by the route surveyed it was 85¼ miles. Chiromo is some 200 feet above sea-level, and the height to be climbed was 3800 feet, for which

[1] By Mr. R. S. Hynde, F.R.S.G.S., in an article on Nyasaland in the *African Review* for June 15, 1901, p. 394.

the steepest gradient he considered necessary was 1 in 40. The railway was to be a narrow gauge—2 feet 6 inches. Only at one part, at the Zoa Falls, was the formation of the terrain such as to render alignment or construction difficult. "So far," he says, in describing his route and work from Blantyre to Chiromo, "easy ground had been found by the valleys of the Luchenza, Tuchila, and Ruo rivers, but at the Falls of Zoa, on the Ruo river, there is a sudden alteration in the shape of the valley. Above the falls it is broad and open, with flat lands bordering the river, but at the falls the valley suddenly narrows to a gorge about 200 feet deep. It continues thus for about 1½ miles, when the valley broadens out again. The question was to get the most economical line located between the flat valley lands above the falls, and those 1½ miles below. The sides of the gorge are very precipitous, and seamed with deep watercourses, and the country inland from the river is broken up into deep valleys and high ridges. The whole place was covered over with dense clumps of bamboo, which very much increased the difficulty of determining the best route for the line. After much work it was found that the most economical way to overcome the difficulty would be by introducing reversing stations, avoiding the very precipitous part of the gorge. This can be done by running down the side of one valley (which is at right angles to the main valley), and crossing its watercourse at a low level, backing out down the opposite side, and round into the neighbouring and parallel valley, crossing its watercourse also at a low level. A second reversing station here will enable the train to proceed with the locomotive in front; and at the place where the line so developed by these zig-zags has debouched again into the main valley, it is just above flood-level in the remaining short distance of the gorge, and the crossings of watercourses only require small bridges instead of high viaducts. The flat-bottom lands of the now widening valley are reached half a mile farther on, and no further serious difficulties were encountered. This development of the line by zig-zags makes the route one mile longer than by the direct route down the side of the gorge below the falls, but would effect a saving of £8000 in construction by avoiding numerous viaducts. This was the only part of the route surveyed which involved any great difficulty in determining the most suitable alignment."[1] An alternative route was surveyed between the Ruo and Blantyre, through the Cholo district. This would shorten the route by 4½ miles, but the gradient would be increased to 1 in 30. At a meeting of the British Central Africa Chamber of Commerce and Agriculture, it was resolved that this Cholo route was the best suited to the wants of the country. Neither of these schemes met with the approval of the Government, on behalf of which a survey was made in 1897-98 for a 3 feet 6 inch gauge. A very complete survey was made by Mr. Tower of the firm of Messrs. Fox and Metcalfe, from Chiromo to Blantyre and thence to Mpimbi, and then from Blantyre to Zomba and Lake Nyasa. Along this route from

[1] "Railway Survey Work in the Shire Highlands of British Central Africa." An Address to the Glasgow Philosophical Society. By Grieve Macrone, Esq., A.M.I.C.E., on 26th January 1898.

Chiromo to Blantyre, Zomba, and Lake Nyasa, it is some 200 or 210 miles; 85 miles from Chiromo to Blantyre; and 125 miles from Blantyre to Lake Nyasa. The desire now among those most concerned is to construct the first section of the railway from Chiromo to Blantyre, with or without any aid from Government. Such a railway will certainly help to reduce the heavy strain on the transport companies, and to promote the speedy development of the Shire Highlands since there is a good system of roads ramifying from Blantyre, the commercial capital, which will feed the railway from most of the districts;[1] but it certainly is not less desirable and necessary for this important commercial highway to Central Africa to carry the railway to the Upper Shire by way of Blantyre to Mpimbi, or by way of Zomba to Liwonde, or the whole way to Lake Nyasa.

But this Nyasaland or Shire Highland Railway is not the only railway scheme which it behoves me to notice in relation to British Central Africa. Two railways have been proposed through Portuguese territory, and their routes surveyed. The first is designed to start at Quilimane and terminate either at Chiromo (according to some maps and accounts), or more probably on the Ruo, which is the border line, above the Zoa Falls. "It is hoped," said Sir Harry Johnston in his Report of 1896, anent Mr. Macrone's survey, "that at this point—the Tuchilo-Ruo Junction—the Blantyre Railway may ultimately connect with the railway which it is intended to build from Quilimane to the British frontier. On this line also a party of engineers—English and Portuguese—have been at work during the last year, and the survey is almost completed from the British frontier to Quilimane. No greater benefit could be conferred on British Central Africa than the construction and efficient working of these two lines, which would place Zomba and Blantyre within one day of Quilimane, which is a better seaport than Chinde, admitting large vessels, and having a more stable bar. As I have already pointed out, the greatest danger to the health of settlers in this part of Africa is the homeward journey, which at present occupies from a week to ten days or more (according to the season of the year) from Blantyre to Chinde, and of which the greater portion is spent on steamers or boats travelling slowly down the very unhealthy, swampy Shire-Zambezi rivers. On this journey those who are at all weakened by their stay in Central Africa find it difficult to resist the malarial fever with which these river valleys are permanently afflicted. If, however, we could travel in one day to and from the comparatively healthy coast port of Quilimane, and get on board the homeward-bound steamer, a residence in Central Africa would

[1] In 1891, says Sir Harry Johnston in his book on British Central Africa (p. 149), there was about one mile of road—that between the mission station at Blantyre and the African Lakes Company's store at Mandala—over which a vehicle could be driven. By the end of 1896 there had been constructed some 390 miles of roads suited for wheeled traffic, while another 80 miles of broad paths had been cleared through the bush for the passage of porters and machillas. These roads are enumerated as follows:—Katunga to Blantyre; Blantyre to Zomba; Zomba to Domasi and Liwonde; Zomba to Fort Lister, and thence round Mlanje to Fort Anderson; Fort Anderson to Chiromo; Chiromo to Chiradzulu and Ntonda; Blantyre to Cholo, and other short roads.

then be followed by a safe and pleasant return." It seems not improbable, therefore, that Quilimane may "come to its own again," and resume its position as the port for the trade of Central Africa.

It has been assumed in this discussion that Chinde is the gateway of this commercial highway to the districts of Nyasaland and the Lakes. The main, if not the sole, advantage of Chinde as a port is the access it affords to the main channel of the Zambezi for river-craft, by which porterage is avoided. Its disadvantages are that its bar admits vessels of moderate draught only, and that its site, which is but a sand-spit, is being washed away by river and sea. At the end of March last year the chief surveyor of the Protectorate was studying the possibility of a permanent connection between the Quilimane river or Quaqua and the Zambezi, by means of a short canal of four miles. During high river, about February or March, boats may pass from the Zambezi, at Mazaro, to the Quilimane river, but during the dry season the bottom of the channel, about 30 yards wide, is about 16 or 17 feet above the level of the Zambezi. It is therefore proposed to canalise this sill, and thereby form a permanent channel. It is thus not at all improbable that Quilimane may resume its old position as the port of the Zambezi valley, both for railway and river, since it has the great advantage of being usable as a port of call by ocean liners.

But there is a second port, with a railway through Portuguese territory, to compete for the Nyasaland trade. The Cabo Delgado district of Moçambique has been leased to the Nyasa Company, and is now known as Portuguese Nyasaland. One of the obligations of this company is to build a line of railway from the coast of the Indian Ocean to the shore of Lake Nyasa. The route of this railway has been surveyed, and it is designed to start from Pemba Bay. According to the *Africa Pilot*, Pemba Bay is one of the finest harbours on the coast; it is about eight miles in length, north and south, by five miles in breadth, and has sufficient water in most ports for heavy draught vessels, and shelter from all winds; and the country around is composed of fertile plains and woods, while the climate is said to be good in comparison with other places on the East African coast. The Nyasa Company has therefore removed the seat of Government from Ibo to the shores of Pemba Bay, where a new city has been founded, called Amelia City or Port Amelia. "During the past year," says Mr. Acting-Consul Wallis in his Report on the Trade of Moçambique for 1900 (Foreign Office, May 1901), "the Nyasa Company—an Anglo-Portuguese company with headquarters at Lisbon—has taken in hand the administration of the northern half of the Moçambique province, and has made immense strides in the development of the country. The head station is at Pemba Bay, the new town being known as Port Amelia. A road has been commenced from the port to Lake Nyasa, work being carried on from both extremities. Administrative stations have been established in the interior and garrisoned with Portuguese and native troops. It is intended to construct a telegraph from Port Amelia to the lake, part of the material for this being already to hand. A scheme for the construction of a railway to the lake has also been started in order to compete for the carrying trade of Lake

Nyasa and the southern territories." The length of this Pemba-Nyasa Railway is estimated at 450 miles; from Port Amelia to the Lugenda or Tola at Metarica, 425 km.; from Metarica to the confluence of the Luambala, 150 km.; thence to the lake at Milonduala, a little to the north of Fort Maguire, about 175 km. "I need say nothing," wrote Sir Harry Johnston in the *Mining World*, March 15, 1897, "about the advantages of Pemba Bay as a harbour, because they are sufficiently known to you. The idea of a railway starting from Pemba to Lake Nyasa, and paying its way bit by bit by opening up the districts rich in coal and india-rubber, seems to me a practicable and prudent scheme. Undoubtedly the port annexed to Lake Nyasa should be Port Maguire, on the site of Makanjira's old town. The line should eventually be connected with the railway which we are hoping to construct bit by bit from the river Shire to Lake Nyasa, and it is by no means impossible that Pemba might be the future seaport of British Central Africa, at any rate of the northern portion of the Protectorate."

Will these railway schemes conflict? There can be no doubt that railways from Quilimane to the Shire Highlands at the Zoa Falls and from Port Amelia to Lake Nyasa are both quite feasible. They will help greatly to the development of East and Central Africa, and will be a great boon to passengers, but will they conflict with the desiderated railway from Chiromo to Lake Nyasa as a paying concern? In the consideration of this question it is necessary to note that it is only the part from Chiromo to the Zoa Falls which will depend on the freights of the Zambezi and Shire canotage. As freights by waterways are all the world over much cheaper than by railways, it is highly probable that the canotage from Chinde or from Quilimane to Chiromo will hold its own against its rivals.[1]

In the south there is also some probability of rival schemes, and of competition between waterways and railways. It has been seen in the enumeration of the ports on the Zambezi that Sena and Tete in Zambezia are served by the canotage from Chinde. Besides the local trade at Tete and its coal-fields, a trade-route has been opened up through Makanga and Mpezeni to Fort Jameson and North-Eastern Rhodesia. It has been proposed to build a railway from Beira to the Zambezi. Starting from Beira the line is divided, according to one scheme, into three branches, one to Ugundani or Ungundani, opposite the confluence of the Shire and the Zambezi; the second to Sena, and the third to Tete. The country between Beira, Fontesvilla, and Ungundani is annually inundated for three to four months; the line will thus pass through the swampy tracts

[1] It has been estimated by a writer in the *Mouvement Géographique* (June 10, 1900) that the shipping companies of the Zambezi could reduce their rates of freight by one-half, if necessary, to compete with railways. The *Stairs* and her two barges cost at Mpimbi £5000; she earned in 1899 £3000 by freights, and £660 by fares. Between Mpimbi and Fort Johnston it takes fourteen hours up stream and nine hours down, with ten tons in the steamer and twenty tons in each barge. The freight upwards is £2 per ton and the fare £3; for the down voyage £2. 5s. and £1. 10s. (M. G. Levêque in the *Mouvement Géographique*, July 20, 1900).

of the Urema and Sungwe. If one line, without branches, is made from Beira to Ungundani, Sena, and Tete, 230, 286, and 472 miles respectively, no such railway could compete with the waterway. Beira has the advantage of being, like Quilimane, an oceanic port of call; the difference in freight from Europe between Beira and Chinde is about 7s. 6d. or 5s. per ton. The freight from Chinde to Tete is £7 per ton. From Beira to Tete by water the freight is, say, £7, 5s. per ton. With a distance from Beira to Tete by rail of 472 miles, the freight would thus have to be not more than $3\frac{3}{4}$d. per ton per mile, to Sena $3\frac{1}{2}$d., and to Ungundani $2\frac{1}{2}$d., in order to compete with the cabotage and canotage from Beira by way of Chinde.

For the western parts of British Central Africa, that is, for North-Western Rhodesia and Marotseland, there will hardly be competition between the Zambezi and the railway from Bulawayo to Tanganyika. This was formerly designed to cross the Zambezi to the west of Zumbo, but the discovery of the coal-field at Wanki or Wankie has led to a modification of the original scheme. "Perhaps the most important event in the recent history of Rhodesia," wrote the Secretary of the British South Africa company in a Memorandum on the present position of railway construction in Rhodesia, dated 29th December 1900, "has been the discovery of coal at Wankie. A company has been formed for the development of the coal-fields, the working capital of which has been subscribed by the British South Africa Company and the Mashonaland Agency, Limited. The coal has proved to be of excellent quality, and only slightly inferior to the best Welsh coal. The importance of a good supply of coal for the gold-mines in Rhodesia cannot be overestimated. The Rhodesia railways have undertaken to construct a line from Bulawayo to the coal-fields. The line will be commenced at an early date." This line is to form a section of the railway to Lake Tanganyika, which will cross the Zambezi at the Victoria Falls, proceed north to the Kafue, passing Sitanda and then midway between the Loangwa and Lake Bangweolo to Abercorn.

Between British Central Africa and the west coast there are several possible lines of communication, but precise details regarding proposed schemes and connections are not accessible. In German South-West Africa the railway from Swakopmund to Windhoek (about 250 miles) has now been constructed as far as Karibib, about 120 miles from the coast. A railway is also to be constructed to the district of Otavi, in the north of German South-West Africa, from Great Fish Bay, in the Portuguese territory of Angola. It is understood that a connection has been arranged between the Rhodesian system and either or both of these ports.

Now that the western and northern parts of Marotseland have been visited and described, it seems that a feasible highway of trade might well be developed between the upper basin of the Zambezi and the coast of Angola. The railway from Loanda is now open to Lucalla, nine km. beyond Ambaca. Lucalla is 363 km. from Loanda, and it is proposed to prolong the railway another 200 km. to Malange. As this line is officially termed the Royal Trans-African Railway, it is in accordance with the scheme as originally conceived to penetrate the con-

tinent from Loanda, but it is now proposed to build a line from Benguella or Lobito to Bihe, and then prolong it to the frontier, where an important caravan highway leads from Angola along the Zambezi and Congo divide. Lobito Bay is described in the *Africa Pilot* as an excellent and secure harbour, the best on that part of the coast. According to the *Revista Portugueza* of March 20, 1901, cited in the U.S.A. *Consular Reports* for June, the engineers have commenced the technical survey of this route from Benguella and Lobito, and the work of construction will be undertaken immediately. Lobito Bay on the west coast, like Pemba Bay on the east coast, may thus become a port of British Central Africa.

In this enumeration and discussion of the several railway schemes in relation to British Central Africa, it has been my chief aim to avoid anything like advocacy on behalf of any of them, but to give an array of facts in Commercial Geography that may help to elucidate the problem of the inland carrying trade of Africa, which is now being energetically attacked from all sides of the continent, and regarding which topographic detail, as well as economic knowledge, are necessary to a right solution and a wise decision.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting held in June.

A Special Meeting of the Society was held in the Queen Street Hall on Monday, 3rd June, when Sir Godfrey Lagden, K.C.M.G., Commissioner for Native Affairs in the Transvaal, late Resident Commissioner in Basutoland, read the paper which is published in this month's *Magazine*. Colonel Wardlaw Ramsay presided, and a vote of thanks to the lecturer was proposed by the Master of Elibank, M.P.

Celebration of the 450th Anniversary of the University of Glasgow.

The University of Glasgow celebrated its ninth Jubilee on the 12th, 13th, 14th, and 15th June 1901, and having invited the Council of the Royal Scottish Geographical Society to send delegates, Dr. James Burgess, LL.D., C.I.E., Honorary Librarian, and Mr. Ralph Richardson, W.S., F.R.S.E., Honorary Secretary, were appointed to represent the Society, and they accordingly attended the University celebrations. On this eventful occasion the programme arranged by the University authorities was a long and brilliant one. It began on *Wednesday, 12th June*, with a Commemoration service in Glasgow Cathedral: followed in the afternoon by a reception in the Bute Hall of guests and delegates by the Vice-Chancellor (Rev. Principal Story, D.D.), acting for the Chancellor (the Earl of Stair, K.T.), who was unavoidably absent. The delegates

(sent by Universities and learned Societies from every quarter of the globe) presented addresses of congratulation at this reception. In the evening there was an "At Home" at Queen Margaret College, and at 9 P.M. a Students' Gaudeamus in the University Union. On *Thursday, 13th June*, two Orations were delivered in the Bute Hall, one by Lord Kelvin on "James Watt," and another by Professor Smart on "Adam Smith," and thereafter the Vice-Chancellor conferred numerous degrees in Laws and Divinity. Among those upon whom the degree of Doctor of Laws was conferred were the Right Honourable Lords Balfour of Burleigh, K.T., and Reay, G.C.I.E., G.C.S.I., two of the Society's Vice-Presidents; Mr. Paul Rottenburg, a member of the Society's Council; Mr. Robert Gourlay, one of the Society's Honorary Treasurers; and Professors T. R. Fraser, M.D., and Bayley Balfour, D.Sc., members of the Society. At 3 P.M. the new Botanical Buildings of the University were opened, and a garden party was held at Queen Margaret College. In the evening there was a very largely attended conversazione in the Bute Hall, Library, and Museum of the University. On *Friday, 14th June*, Professor Bower read an Address by Professor Young on "William Hunter," and in the afternoon an "At Home" was held in the Art Galleries of the International Exhibition. The splendid weather and beautiful surroundings made this function one of the most enjoyable of the celebration. A Banquet by the Corporation of Glasgow in the Municipal Buildings, and a Students' Ball in the Bute Hall brought the Jubilee to a close, although next day, *Saturday, 15th June*, an Excursion on the Firth of Clyde was taken part in by many delegates. It is needless to add that the whole Commemoration was carried through with that spirit, hospitality, and thoroughness which distinguishes the citizens of the great Western Metropolis.

GEOGRAPHICAL NOTES.

EUROPE.

The Reclamation of the Zuider Zee.—The Government has brought forward a bill embodying a less ambitious project than those which have been discussed formerly. It is no longer proposed to convert the whole gulf into dry land, and thus secure a twelfth province, which, it is estimated, would cost no less than twenty-one millions sterling. Instead of being dried up, the gulf is to become a fresh-water lake. A dyke is to be built from the north-east coast of the province of North Holland, to a point named Piaam, between the towns of Makkum and Workum, thus taking advantage of the Wieringen island. Two portions of this lake will, however, be isolated by secondary dykes, and will be reclaimed for agriculture: the first, in the north-west, will be surrounded by the dyke which is to be built across the Amsteldiep, the island of Wieringen, and thence to Medemblik in North Holland; the second, in the south-west, is to be bounded by the coast of North Holland and a circular dyke which is projected between Blokkershoek, the island of Marken, and the southern bank of the Monnikendamer Gat. This scheme has many advantages, among which the following may be mentioned: the extent of coast-line to be protected against the sea will thus be

reduced from 200 miles to 25 miles, for the enclosing dyke, including the island of Wieringen, will be only 25 miles long; the gulf, which receives a great discharge of fresh water, especially from the Yssel, will soon become a fresh-water lake, and will thus supply the province of Friesland with drinkable water—no small boon, as that province has imported fresh water even from England; the absence of tidal movement within this lake will greatly diminish the expenses of the canals and drainage of the surrounding country; the railway which is to be built along the dyke will bring North Holland and Friesland much nearer together, shortening the distance, for instance, between Amsterdam and Leeuwarden by 32 miles; and it is calculated that no less than 114,550 acres of exceedingly fertile land will be set free for cultivation. The cost of the enterprise, including the construction of the dykes, the works necessary for national defence, the indemnity to the fishermen whose occupation will have been destroyed, and the preparation of the new land for agriculture, is estimated at about £7,900,000; and the work is expected to occupy eighteen years.—*Questions Diplomatiques et Coloniales*, June 15, 1901.

The Institute of Colonial Medicine at Paris.—Two years ago, schools of tropical medicine were founded at Liverpool and in London, and Germany, Belgium, Italy, and the United States have established similar institutions. An institute for instruction and research in tropical hygiene and pathology has recently been promoted in Paris. Only graduates in medicine will be admitted: the school is intended especially for French and foreign practitioners who propose to work in the colonies, or are members of the services. For this purpose, £9000 have already been publicly subscribed, in answer to an appeal signed by MM. Berthelot, secretary of the Académie des Sciences, P. Brouardel, dean of the faculty of medicine at Paris, O. Greard, vice-rector of the University of Paris, Edmond Perrier, director of the Museum of Natural History, and E. Roux, of the Pasteur Institute. The great colonial responsibilities of France, and that illustrious tradition of research with which the names of Pasteur, Calmette, Yersin, Laveran, Roux, and many others are associated, should give her a leading place in the new study.

ASIA.

The Indian Famine Union.—A provisional committee was formed on the 7th June for the purpose of organising an Indian Famine Union. The object of this association is the study of the causes of Indian famines, and the promotion of all possible means of prevention. The committee, of which Mr. Leonard H. Courtney is chairman, and Sir W. Wedderburn and Messrs. S. S. Thorburn and M. M. Bhownaggree are joint honorary secretaries, have issued a statement indicating their purpose. "We recognise," they say, "the energy and skill with which the Government of India has, during famine times, performed its stupendous task of feeding millions of starving sufferers scattered over a vast area; and we believe that the various Famine Commissions, by careful scrutiny of past results, are gradually bringing our system of famine relief to the highest point of efficiency. We do not, therefore, consider it necessary to include methods of famine relief within the scope of our inquiry. But there remains the question of famine prevention. Here all possible help is needed to collect facts and mature practical suggestions. And we believe that this help will be welcomed by the overworked officials in India, whose time is fully occupied by the current duties of administration. There are in this country many persons, retired officers, civil

and military, engineers, business men, and missionaries, who have special experience of India, who sympathise with the Indian people, and have spare time at their disposal. Our object is to utilise this experience, goodwill, and leisure for organised work, so as to bring practical aid to the Government of India in tracing the causes of these recurring calamities and in devising means of prevention. We are also anxious to obtain help and advice from the leading authorities in economic science, with a view to dealing on sound principles with the difficult problems involved in safeguarding a vast and scattered agricultural population.

"The first point is to ascertain in detail the present condition of the Indian cultivator and the origin of his difficulties, and this can only be done by a special inquiry conducted under the orders of the Government of India. An exact diagnosis of the patient must precede the application of remedies. We therefore propose to begin our work by moving the Secretary of State to grant this special inquiry. We then propose to form sub-committees to inquire into and report upon the various suggested remedies—*e.g.* irrigation, agricultural banks, village industries, re-afforestation, migration, grain storage, export duties on grain, technical education, arbitration courts, administrative reforms—already before the public, in order that the Government of India may have the support of an enlightened and organised public opinion in dealing with the problem of famine prevention as distinguished from famine relief."

Progress of Manchurian Railway.—Under date of Moscow, March 11, the U.S.A. Consul reports that the rails of the Manchurian Railway have been laid on the division of Khailar (or Hailar) and Chichihar, and that the remaining two-thirds of the whole line between Chita and Vladivostok is nearly completed. On the divisions Chita—Kaidalovo—Khailar and Vladivostok—Nikolsk—Kharbin—Chichihar, working trains are running already, and the whole line, it is supposed, will be opened for passenger traffic by May of the current year.

Indian and German Indigo.—Mr. L. J. Harrington, of the Bogwanpore Indigo Factory, Behar, writes a recent letter to the *Times* regarding this question, in which he differs from Dr. Brunck, the managing director of the Badische Anilin and Soda Fabric Company in the latter's firm conviction that the Government of India would be acting in the best interests of India if they took steps to do away with the cultivation of indigo in India. He expresses the opinion that although synthetic may be superior to vegetable indigo in that it requires no grinding, and also that light shades show more brilliancy by means of the chemical production than with the natural—an advantage balanced by the fact that darker shades are more easily produced from vegetable indigo—there is so little to choose between them that the victory lies with the cheapest producer and seller. Reintroduced into India more than a century ago by the East India Company, who expended large sums in importing European indigo planters from the West Indies, establishing them in factories, subsidising and nourishing the infant industry until it had become the greatest in India and of its kind in the world, and having enjoyed, for more than a hundred years, a practical monopoly in the market, the Badische discovery in July 1897 came entirely unexpected and shone all the more dazedly by rising into an industrial atmosphere hitherto unclouded by competition.

Indian indigo planters realised the fact that they must either produce their product cheaper or disappear. Through 1897 and 1898 prices steadily fell. The 1898 crop was sold in Calcutta at an average price of Rs. 150 per maund. The crop for the following year, owing to rain and floods, reached only 85,000 maunds, against 124,000 maunds the previous year. The cultivation of indigo appeared to be declining; prices rose 25 per cent., and the German company expended

£500,000 in bricks and machinery. Yet the Indian indigo crop on sale for 1900 reaches 112,000 maunds.

A cheaper method in production will also fortify the older industry. A more careful style in working, the sowing only of good lands, and other measures, have gradually reduced the 170 rupees per maund, which constituted the cost of production when synthetic indigo made its appearance, to 100 rupees per maund; and Mr. Rawson, a well-known chemist, whom the Government has engaged for experimental purposes, already claims to have discovered a process which will give 25 per cent. increase on the produce. An agricultural chemist has also doubled the output from old lands by the application of certain manures.

AFRICA.

Sugar Production in Zambezia.—The rich, fertile district along the Lower Zambezi and the Shiré rivers promises to occupy soon a prominent position as a sugar-producing country. There the sugar industry gives promise already of becoming very important within the next few years. One company alone has 1160 acres under cultivation at the present time, and shortly intends to bring in a further tract of 2500 acres, while several other companies and private planters are either making preparations for planting sugar, or have already started plantations. The land is reported to be well fitted for the growth of the sugar-cane. The supply of labour is ample; the sugar produced is said to be superior to that of Egypt; and, with the experience gained in Natal, the district round Chinde should become one of the great cane-sugar producing centres of the world.

Arabuku Forest in Malindi District of Zanzibar.—In the *Board of Trade Journal* for June 20, it is announced that the Association of Chambers of Commerce of the United Kingdom has received from the Foreign Office, for the use of any Chamber desiring to see them, ten samples of wood from a forest near Arabuku in the Malindi district of the Saiyidiya Province of Zanzibar. The forest is about fifteen miles long by six miles broad. The following is a statement showing the approximate amount of solid timber to be obtained from each kind of tree, according to the samples, when it has reached a mature age :—

No. 1.	Mgambo,	length about	40	feet by	18	inches square.
„ 2.	Mrihi,	„	40	„	24	„
„ 3.	Bamba-Koji,	„	10	„	36	„
„ 4.	M'pingu,	„	6	„	6	„
„ 5.	M'bebeda,	„	16	„	12	„
„ 6.	Mkhu,	„	10	„	9	„
„ 7.	Muhuhu,	„	16	„	10	„
„ 8.	M'gate,	„	16	„	16	„
„ 9.	M'gurure,	„	8	„	6	„
„ 10.	M'guri,	„	12	„	10	„

Different qualities of timber, it is said, in addition to the samples sent, can be obtained from the forest; and it is asked if it would not therefore be worth the outlay of some enterprising firm to send an expert from home to judge if it is worth the trouble to negotiate with H.M. Government to obtain a concession to work the same.

AMERICA.

Sugar Industry of the West Indies.—The important experiments by Professor d'Albuquerque, honorary consulting chemist to the Imperial Agricultural Department, and Mr. Bovell, superintendent of the Botanic Station, which have been

conducted in Barbados during the past season, for the purpose of testing the economical value of various descriptions of seedling and other sugar-canes, in order to assist the planters in selecting the canes most suitable and profitable, have resulted in a manner which promises to be an important factor in the economic future of the sugar-producing islands. By an experimental system which has taken into account the extreme varieties of soil and climate typical of the comparatively low area of Barbados, and an arrangement by means of which the canes used in the investigation were not grown on specially prepared plots in the Botanic Gardens or on artificially prepared soil, but on seven different estates throughout the island "grown by the planters themselves under exactly the same conditions as other canes — there was nothing exceptional in their treatment," the result arrived at in the case of the most favourable cane shows a gain of more than a ton of sugar per acre. But the Imperial Commissioner of Agriculture, knowing from experience the past recklessness of the planter in speculating, under totally different conditions of soil and climate, advises them to select three or four only of the most promising canes which have been experimented with, and to finally adopt the variety which steadily stands the test of local conditions.

Regarding the question of sugar bounties in connection with this question, it is estimated that, at the average price of the five preceding years, 5000 tons of sugar were estimated in 1899 to sell in Barbados for £53,427. This sum, acting on the common belief that the abolition of the bounties would raise the price of sugar by some 25s. a ton, would amount to £59,677, and represent a gain of some twelve per cent. per acre. Independent of the sugar bounties, however, the gain resulting from these experiments amounts to 40 per cent. per acre, and thus the numbers of acres which yielded 5000 of sugar, will, under the new condition, yield 7000 at a value of nearly £75,000. The abolition of the bounties can therefore only give the planter an advantage of less than £7000 for 5000 tons of sugar, while the adoption of the improved methods will give him an advantage of £21,000 on the same amount. With the combined advantages deducing from the abolition of the bounties and the fruit of these experiments, the 5000 tons of sugar above would be valued at £27,000.

Mr. Mortineau—a very high authority—is, however, of the opinion that the abolition of the bounties will tend to lower rather than increase the price of sugar.

The planters, therefore, would do well to leave the bounty question alone, and devote their energies fully to the scientific development of their industry—a development, which, in their case of cane sugar, compares in the opposite extreme to the case of European beet sugar, which has reached its limit in the matters of its powers of production.

Argentina.—The harvest of cereals, now upon the eve of commencing, will decide the economic condition of the incoming year. Statistics gathered from some 600 stations by the Department of Agriculture have acquired the information that the area laid down in wheat is 8,000,000 acres, and with linseed 1,500,000 acres. The hailstorms in the region of Santa Fe, although they have inflicted considerable damage to the wheat crop, it has been confined to certain localities, and will not entail a loss of more than 15 or 20 per cent. in the total yield, which, taking a low average of 12 bushels to the acre, would produce 96,000,000 bushels, and under favourable conditions ought to exceed that amount.

The native demand for consumption and seedling purposes is about 22,000,000 bushels, which leaves an exportable surplus of nearly 74,000,000 bushels. The

linseed crop now being harvested will probably surpass all estimates regarding the quantity for exportation, though the shipments for the coming season are unlikely to fall below 500,000 tons—an estimate which means £5,000,000 clear gain to the country. The maize crop will probably furnish a surplus of 50,000,000 bushels. The three cereals taken together will certainly furnish an exportation value of not less than £20,000,000, while a more hospitable season might have augmented this figure to at least £25,000,000.

With the proximity of the harvest 17,000 persons arrived, chiefly from Italy, to which they return in time for the European harvest, after the Republican one is over, and constituting an emigratory ebb and flow which render so untrustworthy all statistics on this matter.

The Government intend to mark the channels into the docks at Buenos Ayres and the vicinity of the island of Martin Garcia with buoys lighted with gas. The consent of the Uruguayan authorities has been obtained to place buoys on that portion of the Martin Garcia channel traversing Uruguayan waters.

The Montevideo Harbour Works.—The tender of the French syndicate headed by Messrs. Allard and Company for the construction of the new port, at a cost of slightly over £2,000,000, has been accepted by the assessing committee.

Dr. Robert Bell, M.D., F.R.S., F.R.G.S., who has succeeded the late Dr. George M. Dawson as Director of the Geological Survey of Canada, has entered on his forty-third year of continuous field-work in British North America, and is now investigating the region of the Great Slave Lake in the Mackenzie river basin. Dr. Bell entered the service under the late Sir W. E. Logan, in 1857, at the age of fifteen. Beginning at the east coast, he surveyed the Gaspé peninsula from Percé to Rimouski, from the St. Lawrence to the Baie des Chaleurs, thence to Quebec, the eastern townships, the Saguenay and Lake St. John region, the north shore of the Gulf of St. Lawrence, the west coast and the interior of Newfoundland, and parts of Nova Scotia and New Brunswick, and the whole coast of Labrador and some of the neighbouring islands. Dr. Bell has also surveyed most of the southern coast of Baffinland, and the interior as far as the lakes; the greater part of the coast of Hudson Bay and some of the islands to the north of it; the rivers flowing into James Bay; and, farther north, the Hayes, Steel, and Hill rivers, the Oxford and Knee lakes, and the Nelson river. Farther south, his geological work comprises the Ottawa river from its mouth to its extreme source, including surveys of the Gatineau, the Upper Ottawa and some of the streams east of Lake Temiscaming, the Montreal river and the country to the north and south of it, the country north of Lake Huron to the watershed, Lake Nipissing and Mattawa river, the French, Spanish, Missisagi, and White rivers to their sources; Blind, Thessalon, and Garden rivers, also Lake Temagami, Lady Evelyn, and surrounding lakes; Temagami and Sturgeon rivers; and all the geographical as well as geological features in the Sudbury mining district. He had visited every square mile of the several islands of the Manitoulin chain before any township surveys had been made or a single settler had gone there. His purely geological labours comprise the western or lake peninsula of Ontario, while on the north side of Lake Superior, besides the geological work, he surveyed nearly all the rivers, Nipigon lake, the uppermost of the Great Lakes of the St. Lawrence; Nipigon river, Long lake, and Pic river, and the country northward of these to the Albany, and most of the thirteen rivers flowing into Lake Nipigon, together with their lakes. Westward of Lake Superior he has explored all the wooded country to the prairies and made the first passably good map of the Lake of the Woods

(published in 1881). In the northern parts these extended operations included Minnietaki lake, Lonely lake (100 miles long, and Lake St. Joseph or Osnaburgh lake, nearly as large, the English river and its chain of lakes, Shoal lake and Red lake, and its river. The international boundary line was examined geologically from Lake Superior westward to Lake of the Woods, including Rainy lake and river.

A track survey was made of most of the shores of Lake Winnipeg; Lake Manitoba and the boat route from it to Lake Winnipeg were explored, as well as the "mountains" along the west side of the Winnipeg basin, and a track-survey, showing the details of the course of Red river from Winnipeg city to the lake of the same name. Farther west the Assinniboine, Swan, and Qu'Appelle rivers were explored, as well as considerable portions of the North and South Saskatchewan, also the prairie region between these streams, and thence southward to Montana. Two routes were explored from the North Saskatchewan to Clearwater river, and a good track-survey made of Lac la Biche and its river to the Athabasca, as well as of this stream itself all the way to Athabasca lake, and of the waters around its western extremity, Lac la Loche, Clear lake and Isle à la Crosse lake, Beaver river, Green lake, and the route thence to Prince Albert.

Most of this work was accomplished in canoes, with Indian and half-breed voyageurs. In the course of his surveys Dr. Bell has mapped the geographical distribution of the Canadian forest trees, and has collected the folk-lore of Indians and Eskimoes. An appreciation of his extensive labours is given in *One of Canada's Explorers*, by Mr. Charles Hallock, from which the above account is taken.

New Railway in Mexico.—It is announced in the *Railway Age* of New York as cited in the *Board of Trade Journal*, June 20, that the South-Western Railway Company of Yucatan has completed arrangements with the Mexican Government for building a railway 300 miles long from Peto, in the interior of Yucatan, to the Bay of Espiritu, with a branch to the Bay of Ascension, and from Valladolid to a point on the Peto line.

Free Homesteads in Canada.—It is officially announced, says the U.S.A. Consul at Winnipeg, in a Report, dated March 29, 1901, that a block of 60,000 acres of free-grant lands in the Rainy River district of Ontario has been surveyed, and is open to settlement under the "homestead laws" of Canada. Of these lands, any male head of a family, or sole female head having a child or children under eighteen years of age, may locate 160 acres free, and may also purchase an additional 80 acres at $1 per acre. The homesteads must clear and cultivate at least 15 acres, and in no one year less than 2 acres, during three years; must build a habitable house at least 16 by 20 feet in size; and must continuously reside on the land for three years after location. If the 80 acres additional are purchased, at least 15 of it must be put under cultivation within three years. Patents may issue at the expiration of three years from date of purchase, or sooner if settlement duties have been performed. Minerals and pine timber are reserved to the Government, but the homesteads may use such pine-trees as may be needed for building, fencing, and fuel, and may sell such pine trees as may be necessarily removed in the process of clearing, but must pay timber dues on all pine timber sold. All timber remaining on the land when patents issue passes to the patentee. These lands are very fertile, and covered by a dense forest, generally of valuable timber. The Ontario and Rainy River Railway, now nearing completion, runs through this block of land, and brings it within easy reach of markets. This railway is a link in the Canadian Northern system, which, within the next six or eight months,

will have a continuous line from Port Arthur, on Lake Superior, to Winnipeg, and thence 300 miles north-west.

New Port for Bolivia: Quijarro.—In his remarks at the meeting of the Royal Geographical Society, London, February 25, 1901, in the discussion of Colonel Church's paper on South America, Señor Aramayo announced that in November last an exploration was also made, at the expense of the Bolivian Government, on the river Paraguay, as far as the Laguna Gaiba, with satisfactory results, by Captain Bolland of the English Navy. Under date May 25 our corresponding member, Mr. A. A. G. Dobson, of Buenos Aires, has sent us the following account of Captain Bolland's expedition on the river Paraguay. Its aim was to locate a port for the Republic of Bolivia, and this information has been personally communicated to Mr. Dobson by Captain Bolland, who is shortly going to make an expedition to the river Amazon :—

For a long time the Bolivian Government has considered the difficult problem of a port for their country. Both the river Amazon and the river Paraguay have in turn been discussed as possible waterways.

At the end of last year the Bolivian Government commissioned Captain Henry Bolland, of the British Mercantile Marine, an expert in the navigation of South American rivers, to make a survey of the upper portion of the river Paraguay for the purpose of establishing a port. Captain Bolland started up stream from the Brazilian port of Corumba, on the 14th of November 1900, in a small paddle steamer 65 feet long, of 3 feet minimum draught, and made a track survey of the river Paraguay, checked by meridional and chronometric observations, for a distance of 140 miles, finding a minimum depth of 7 feet. Here he reached Lake Gaiba, situated near the junction of the Paraguay with the river Pedro Segundo or Pando. The river Pando divided Lake Gaiba into two parts, Lake Gaiba and Lake Gaiba Superior—a third lake, Lake Gaiba Merim, was situated to the west, but had no connection with the first two. Captain Bolland proceeded to make a careful survey of the lower Lake Gaiba, which he found to have an area of about 26 square miles, and a maximum depth of 12 feet, the water at the time being 10 feet 10 inches below high-water mark, as observed on the shore. Captain Bolland decided to establish the new port at the SW. corner of this lake, and named it Quijarro, in honour of the Bolivian minister of that name in Argentina. He found the position of the spot to be lat. 17° 47′ 35″ S., and long. 57° 44′ 38″ W. Green., the magnetic variation being 4° 44′ E.

Captain Bolland is of the opinion that Lake Gaiba will offer advantages for the position of the new port, on account of its being on Bolivian territory (Lake Gaiba is situated on the Bolivian boundary), on account of its being a natural harbour, and on account of its being nearest on the river to the important Bolivian commercial centre of Santa Cruz. A railway 370 miles long is now projected from this latter town to Lake Gaiba. (Cf. *S.G.M.* xiv. pp. 155-6.

AUSTRALASIA.

New Zealand Pastoral Industry.—Mr. J. H. Gilruth, chief veterinary surgeon and bacteriologist to the New Zealand Government, left Wellington in November 23 last for Great Britain. His official visit to this country is, primarily, to select fifteen veterinary surgeons whose services are required in connection with the new Slaughtering and Inspection Act which comes into force in April next, and which, it is estimated, will have a beneficial effect commercially, by constituting an increased demand from the consumer, with an increased price for the producers, and, from a healthy point of view, upon the whole community.

The New Zealand Government is also, through Mr. Gilruth, turning its attention to improving the breed of cattle and horses in the colony, and he is commissioned to purchase twelve shorthorn bulls from the best milking strains in Great Britain, and six thoroughbred stallions. These latter are intended for breeding horses for the cavalry and mounted infantry divisions of the British Army. New Zealand is eminently suited for the rearing of this class of horse. During the present war, more than 200,000 horses have been purchased in the colonies and in foreign countries, and the New Zealand horses are said to have been pronounced by army experts the best of those entering South Africa. Forty pounds apiece was the price often paid by army buyers for these animals.

With the improvement and prospective increase of their most important industry, the New Zealand Government is alive to the necessity for new markets for their produce. The Cabinet has decided to invite tenders from shipowners for a two years' steam service between New Zealand and South Africa—a service which, it is estimated, will open up a considerable trade between the two colonies, though a pessimistic view is visible among shipping people regarding a dearth of back loading. The New Zealand Government in inviting tenders for the contemplated line—which stipulate that the steamers shall call at five New Zealand ports and three or more ports in South Africa—show a praiseworthy, if shrewd, foresight in preparing to gather in a portion of the rich commercial harvest of which South Africa will be the field, when the land settles down.

NEW BOOKS.

Celtic Folklore, Welsh and Manx. By John Rhys, M.A., D.Litt. Oxford: Clarendon Press, 1901. 2 vols. Pp. 718. *Price* 21*s.*

In Wales the folk-tale proper seems to have disappeared, or nearly so; but legends attached to places are still current, though often in a mutilated condition. The first three chapters are devoted to Welsh legend, including stories of fairies; the next two chapters to Manx folklore. Then follow chapters on the folklore of wells, cave-legends, place-name stories, etc., till we reach the twelfth, which is headed "Race in folklore and myth."

On the whole, Professor Rhys may be said to handle the details of Welsh folklore as so many pegs on which hang his ethnological conjectures. Following the lead of Mr. Gomme, he tries to separate the folklore of the principality into two groups of Aryan (Celtic) and non-Aryan (pre-Celtic) origin. Used in this sense the word Aryan can only denote the particular stage of culture to which the Greeks, Romans, and Sanscrit-speaking Indians had reached when they enter the historical period. Every custom or folklore incident that does not exactly tally with what we know of the customs and modes of thought of the above-mentioned peoples is supposed by Professor Rhys to be most probably an inheritance from the non-Aryan population that preceded the Goidels. Such a line of reasoning is not absolutely convincing. The Aryan-speaking peoples must have passed through all the stages of immature culture that other less civilised peoples are still passing through. For it is quite certain they could not have sprung at one bound from savagery into the fulness of civilisation as Athene sprang fully armed from the head of Zeus. So it is extremely likely that an outlying member of the family, like the Goidels, who may have come to Britain as early as 1200 B.C., were at a vastly lower stage of civilisation than the Greeks and Romans when they first appear in the historical arena. The custom known as the *couvade*, which seems to have been known to the

Irish, may be taken as a case in point. Though at present it is only known to exist among people of a very low grade of intelligence, it hardly deserves the epithet of "bedlamite" which the learned professor applies to it. When once the conviction arose that the actions of the father have a direct influence on the physical and psychical nature of the infant at the time of its birth, it became necessary for the father to avoid everything that would prejudice the growth or temperament of his child. So he took to his bed, and was put on strict diet, while his wife went about her usual vocations. Bachoven, the learned author of *Das Mutterrecht*, thought a trace of this custom was to be found in Greek mythology The instance he adduces may be far from a certain proof, but is evidence that he did not draw a hard line between Aryan and non-Aryan custom in Hellenic folklore.

The Welsh do not now distinguish between fairies properly speaking and nixies, though originally land and water spirits must have been distinct, for their functions cannot have been the same. The house-spirit has also merged into the ordinary fairy. Yet from this conglomerate Professor Rhys segregates certain qualities attributed to modern fairies, and regards them as historical data, applicable to the people that preceded the Picts and Celts in the British Isles. He finds that these people must have been sallow, short of stature, living underground, disliking iron, using little household furniture, disliking the green sward being turned up by the plough, unable to count above five, and possessing a language of their own. Some of this may have been true of the neolithic inhabitants of Britain and Ireland, though we know they were not remarkably short of stature, and could not have been, as the Professor supposes, allied to the Lapps. For the latter are characterised by extreme brachycephaly, while all our known neolithic skulls are dolichocephalous.

When the orbit of a planet deviates from its calculated course, an astronomer supposes that some undiscovered planet must be the cause of the disturbance. So to account in Irish and Welsh grammar for certain non-Aryan features, which are found to occur in the Old Egyptian and the Berber languages, the Professor conjectures that a people with Libyan, possibly Iberian, affinities, whom he identifies with the Picts, occupied the British Isles before the arrival of the Goidel. He does not state whether the Picts were in the neolithic stage or not, but as he says they introduced the noble art of tattooing, and apparently nothing else, we may assume that they were so. He believes they were taller and blonder than the earlier small race of Lapp affinities of whom our anthropologists know nothing, so that really the Picts seem to resolve themselves into the long-headed neolithic inhabitants who are generally supposed to be represented by the short, black-haired people found in Ireland and Scotland. On the whole, then, Professor Rhys's conjecture hardly coincides with the usual theory founded on craniological observations. It is true that anthropologists believe that British neolithic skulls are of the Cro Magnon type, a type which also includes the Berber and many Iberian crania. But we cannot conclude from that fact that neolithic man in Great Britain spoke a language akin either to the Berber or to an Iberian tongue. That his language was non-Aryan may be taken for granted, but no more. And if the Picts were related to the Berbers, we should expect to find pottery of types similar to those found at Nagada (neolithic) in Egypt, and among modern Kabyles. But this is not the case.

As Professor Rhys places the arrival of the Goidels in the sixth or seventh century B.C., and the short-headed people that introduced bronze may have reached our shores some 1000 or 1200 years B.C., there is a hiatus of several centuries to be accounted for. Anthropologists have hitherto supposed that these

brachycephalous people were Goidels, and for the present their theory, as against that of the philologists, seems best entitled to hold the field.

Though it is possible to dissent from Professor Rhys in some of his views, his two volumes contain much that is very interesting and suggestive—for instance, his suggestion that the neolithic people constructed their graves above ground from a superstitious fear of breaking the soil—while his comments are in so cheerful and conversational a strain that our interest is kept ever on the alert.

The Evolution of Geography: a Sketch of the Rise and Progress of Geographical Knowledge from the Earliest Times to the First Circumnavigation of the Globe. By JOHN KEANE. London: Edward Stanford. Pp. xvi + 160. *Price* 6s.

Nothing could be more charming than the way in which Mr. Keane has sketched the evolution of geographical knowledge from the beginnings of history down to the year 1522, when Sebastian del Cano safely anchored his ship *Victoria* in the harbour of St. Lucar, from which place, under the great Magellan, who was killed on the voyage, he had started to circumnavigate the globe three years before. The volume is a small one, but Mr. Keane has the gift of concentrated writing whose interest never flags. Nothing of importance seems omitted, though the text of the volume is within 150 pages. Beginning with the geographical description of the Book of Joshua, B.C. 1500, "a treatise of marvellous accuracy of statement," the Hebrew notion of the world's figure is sketched, in which Jerusalem is placed as the centre of the universe: "I have set Jerusalem in the midst of the nations," Ezekiel v. 5, an idea which, taken literally, had a strong reactionary influence on geographical science in early Christian times. The Hebrews never expanded, but their neighbours the Phœnicians explored both to the west and to the east. From Egypt it is, however, that the earliest book of travels is to be found—*A Tour in Palestine*, written by an engineer officer about B.C. 1400. Thence we are carried on by the Greeks, whose early geographical notions are chronicled by Homer and Hesiod, and whose practical knowledge of geography was extended by their numerous colonists.

Anaximander, the pupil of Thales, invented maps, B.C. 600, and introduced the use of the gnomon and of latitudinal observations, probably from Babylon. Hecatæus of Miletus (B.C. 500) wrote the first great geographical treatise, *A Survey of the World*, and improved the map of Anaximander. Herodotus (B.C. 480), "the father of history," was the greatest of travellers and recorders of historical and geographical information, which should never be separated. It is Herodotus who chronicles the interesting voyage of a Phœnician crew who sailed down the Red Sea and went on till they found "the sun on their right hand," showing that they must have crossed the Equator and doubled the Cape, for they returned by the Pillars of Hercules to the Mediterranean. The colonising expedition of the Carthaginians under Hanno about the same time passed through the Straits of Gibraltar, and went as far south as Sierra Leone. Then came the expeditions of Xenophon and Alexander the Great, and the travels of Alexander's captain, Nearchus, to the eastern seas, all carefully preserved. To this period belongs the earliest *Periplus* or book of sailing directions, that of Scylax, for the Mediterranean, a form of practical geographical handbook "written by merchants for merchants," which received great development as time went on, particularly by the Romans, and indeed is the prototype of the "portolani" of the Middle Ages and of the familiar road-book used by our grandfathers. Eratosthenes (B.C. 240) was the first scientific geographical writer, and he published three books on geography. Like his predecessor Euclid, he believed the world to be spherical, he estimated its size, and drew on his globe parallels of latitude and meridians. Tracing the work

of Hipparchus and Strabo, Mr. Keane brings us to Ptolemy of Alexandria (A.D. 150), whose maps were founded on astronomical observation, and whose work was the culmination of ancient science. With the advent of Christianity, the science of the ancients became lost, and Christian geography and Christian maps were founded on the too literal interpretation of the biblical statement that Jerusalem was the centre of the world. Pilgrimages and the crusades, however, necessitated the use of maps and increased the practical geographical knowledge of the church and the world. The earliest Christian guide-book was compiled in 333 by a Bordeaux pilgrim, an *Itinerary from Bordeaux to Jerusalem*. Maps followed in time, the earliest known being by an Egyptian monk, Cosmas, in 547. Although these maps gradually improved, they are to us bizarre and fantastic. Even the Borgian map of 1452, published while Columbus was a boy and Prince Henry a man of fifty-eight, shows a flat world with Jerusalem in the centre. Meanwhile the Arabs, who followed the traditions of the Greeks, never made any great advance in geographical science, yet an Arab map of the fifteenth century gives a wonderfully correct outline of Europe, Asia, and the north of Africa, in marked contrast to the Christian maps of the period.

With the advent of Henry the Navigator, Prince of Portugal (1394-1460), came the dawn of modern geography, and from this point we refer the reader to the pages of Mr. Keane, promising him that he will find interesting and well-proportioned descriptions of the work of the great navigators of the fifteenth and sixteenth centuries down to the circumnavigation of the globe in 1522. The book is fully illustrated by portraits of early travellers and by reproductions of ancient maps. Most of the latter have, however, been independently reproduced by Sir John Murray in his article on "The Discovery of America by Columbus" in this *Magazine* for November 1893.

It should be added that this admirable concentration of geographical history includes a good Index, and a short but well-chosen Bibliography.

Helwân and the Egyptian Desert. By W. Page May, M.D., B.Sc. With articles by Professor A. H. Sayce and G. Schweinfurth. London: G. Allen, 1901. Pp. 94. *Price* 3*s.*

The fashionable "Health resorts" of Egypt at present are Mena House, Helwân, Luxor, and Aswan. The two first are near Cairo, whilst the two last are considerably up the Nile. Each has its special attractions, but none has hitherto had devoted to it so valuable and well illustrated a handbook as this. The waters of Helwân, sulphur and saline, salt and chalybeate, which burst forth in several springs at a temperature of 91° Fahr., have been sought for their healing properties since the days of Amen-hotep (B.C. 1600), and the new bath establishment opened by the Khedive in December 1899 is said to be equal to anything of the kind in Europe. Dr. May maintains that the daily range of temperature at Helwân (21°) is less than at Luxor or Aswan, but we scarcely think that an invalid could, as he says, live out of doors till 9 P.M. from the beginning of November to the end of March, for (at least during January and February) the temperature falls rapidly after sunset. Mr. Schweinfurth's survey-map of the Helwân district accompanies this complete little volume.

Jerusalem. A Practical Guide to Jerusalem and its Environs, with Excursions, etc. By E. A. Reynolds-Ball, B.A., F.R.G.S. With Plan of Jerusalem, Maps, and Illustrations. London: Adam and Charles Black, 1901.

Much of our criticism of Mr. Cooke's *Palestine* applies to this Guide. It is more popular than scholarly, more a compilation than original. But that is to be

expected in a Guide, and certainly this little volume is practical and up to date. The writer, for instance, has gone to the great medical missionary, Dr. Mackinnon of Damascus, for advice as to money. The cost of touring in tents with a dragoman per day is given, but it should be added that that depends on the number of the party. For thirty days in April and May the Professor of Hebrew in the Glasgow College of the United Free Church was under canvas with a party of eleven students and others, and his experience enabled him to arrange with T. Cook and Sons most satisfactorily because of the number. We recommend this guide-book as the latest, but nearly the whole of Part III. on the topography of Jerusalem will have to be rewritten by next travelling season in 1902.

Romantic Essex: Pedestrian Impressions. By REGINALD A. BECKETT. London: J. M. Dent and Co., 1901. Pp. vii+270. *Price* 3*s.* 6*d. net.*

Essex abounds in landscape "beautifully and characteristically English." It is full also of antiquarian interest. Mr. Beckett has wandered on foot all over it at divers times and seasons: through its lanes and along its footpaths, with an eye always and everywhere for the picturesque in scenery and association. In this dainty volume he describes with kindly pen and in pensive mood what he has seen and heard. Any one of kindred spirit who takes him for guide will enjoy his company, and will doubtless find with him that "the soul of Essex" is "the friendly simplicity of the landscape, of the homes of the people, and of the people themselves."

The Scenery of Scotland viewed in connection with its Physical Geology. By Sir ARCHIBALD GEIKIE. Third Edition. London: Macmillan and Co., 1901. Pp. 540. *Price* 10*s. net.*

The first edition of this well-known work appeared in 1865, and the second in 1887. The present edition has fifty-nine more pages than the second, besides containing new Vegetation and Orographical Maps of Scotland by Mr. J. G. Bartholomew, whilst greatly improved Geological and Glaciation Maps of Scotland are likewise contributed by him. The origin of the work was to enforce the principles of those great Scottish geologists, Hutton and Playfair, showing the potency of Denudation as a factor in the evolution of Scenery; and Sir Archibald Geikie has spared no pains in gathering material, especially for this edition, which completely vindicates these principles. Officially, as head of the Geological Survey, he has examined the evidence furnished from every part of the British Isles. As a traveller, he has collected it from the continent of Europe, from Norway to the Mediterranean, from the Faroe Islands to the Caucasus. Crossing the Atlantic, he pushed his researches to the Far West of North America, and, whilst he found the Huttonian principles established there as firmly as in Europe, he objects to the technical topographic nomenclature adopted by American geologists as "unnecessary, and calculated rather to obscure than to simplify the investigation, affecting a precision which finds no counterpart in Nature, and involving theoretical conceptions which may not always be well founded.'

The author hazards the opinion that the charm of "the landscapes of Tweed and Gala, Yarrow and Ettrick, that has inspired so many songsters," is due not so much to their beautiful scenery as to the human associations which have consecrated them, an opinion which is certainly open to question. Again, he objects to planting trees on hillsides, saying we might as well put the Apollo Belvidere into a greatcoat, thus ridiculing a practice very generally approved, and which our best judge of Scottish landscape enthusiastically followed by covering the hills around Abbotsford with woods planted with his own hands.

The author likewise does not quite satisfactorily explain the origin of the river terraces found in Scotland and all over the world. But he always writes gracefully, and takes the dryness out of geology, whilst the wealth of geological knowledge which he displays is such as none but a hard-working field geologist for the past forty years, like Sir Archibald Geikie, could ever have accumulated.

Our Forests and Woodlands. By JOHN NISBET. "Haddon Hall Library." Pp. vi + 340, including Index. Twelve Illustrations. London : J. M. Dent and Co., 1900. *Price 7s. 6d. net.*

The first two chapters are devoted to "Woods, Forests, and Forestry in Ancient and Modern Times," an account which would have been more valuable if the author had given his historical authorities. The succeeding chapters on the various classes of our woodlands are interesting and useful. The work concludes with the author's suggestions for the improvement of British forestry.

Forestry in British India. By B. RIBBENTROP, C.I.E., Inspector-General of Forests to the Government of India. Calcutta : Office of the Superintendent of Government Printing, 1900. Pp. ii + 245. With four Maps.

The author, on the eve of his retirement from the service, gives a general description of the Indian forests, with an account of the introduction of rational forestry, its gradual development, and its financial results. The work comprises a chart of the average annual rainfall, a map showing the distribution of forest lands under Government control, and two others illustrating the progress made in forest surveys, and in working plans or regulations for systematic management. It forms a valuable addition to the literature on this important subject.

The "Royal" Road Book of England. London and Edin. : Gall and Inglis. *Price 1s. net.*

This is an abridgment from the "Contour" Road Book, and contains three hundred contour plans of the main routes ; a map ingeniously folded is also given.

A. Hartleben's Kleines Statistisches Taschenbuch über alle Länder der Erde, 1901. *A. Hartleben's Statistische Tabelle über alle Städten der Erde*, 1901. Wien : Hartleben's Verlag.

These useful statistical publications have been revised and brought up to date ; the form of publication is the same as in previous years.

Switzerland and the adjacent portions of Italy, Savoy, and Tyrol. Handbook for Travellers. By KARL BAEDEKER. With 59 Maps, 13 Plans, and 11 Panoramas. Nineteenth Edition. Leipsic : K. Baedeker, 1901. Pp. xxxvii + 530. *Price 8 M.*

Spain and Portugal. Handbook for Travellers. By KARL BAEDEKER. With 7 Maps and 47 Plans. Second Edition. Leipsic : K. Baedeker, 1901. Pp. lxxxviii + 608. *Price 16 M.*

Belgium and Holland. Handbook for Travellers. By KARL BAEDEKER. With 14 Maps and 22 Plans. Thirteenth Edition, revised and augmented. Leipsic : K. Baedeker, 1901. Pp. lxvi + 442. *Price 6 M.*

In these new editions of Baedeker's *Switzerland*, *Spain and Portugal*, and *Belgium and Holland* there is every evidence of conscientious revision, so thorough that to every traveller the new edition will be indispensable, even although he may happen to have the previous one on his bookshelf. In the

Spanish Guide an interesting new excursion to the Balearic Isles has been introduced, while the *Belgium and Holland*, compared with early editions that one has used, is almost a new book. *Switzerland* is bound in a new kind of waterproof cloth, an improvement which should be much appreciated by tourists, especially cyclists, pedestrians, and climbers.

Iceland. Sportsman's and Tourist's Handbook. Third Edition. Pp. 118. With a Map. Leith: Geo. V. Turnbull and Co., 1901. *Price* 2*s. net.*

This is a compact and practical little handbook specially compiled for the guidance of passengers by the Royal Mail steamers of the United Steamship Company, and published annually. The present edition has been revised by Iceland's most famous guide, THORGRIMUR GUDMUNDSEN of Reykjavik, and as a condensed compendium of tourist's information should prove most useful to all who are tempted to explore the wild charms of "Ultima Thule."

Le Puy-de-Dôme et Vichy. Guide du Touriste, du Naturaliste, et de l'Archéologue. Par M. BOULE, P. GLANGEAND, G. ROUCHON, and A. VERNIÈRE. 109 Dessins et Photographies, 3 Cartes. Paris: Masson et Cie. Pp. 378. *Price* 4 *fr.* 50.

This handbook represents something more than the mere tourist's guide. It is clearly designed for the student and more intelligent traveller. Besides giving all the ordinary information requisite for tourists, it summarises the most interesting features of the geology, orography, hydrography, climate, flora and fauna, anthropology, archæology, history, population, agriculture, products, commerce, industry, and administration of the country. The adequate execution of such a comprehensive treatment has been ensured by intrusting the work to different writers, who are each responsible for their special subjects.

Donside. By ALEX. INKSON M'CONNOCHIE. Aberdeen: W. Jolly and Sons, 1901. Pp. 134. *Price* 1*s.*

The Highland grandeur and royal patronage of Deeside have long made it famous and fashionable, but the softer charms of Donside are little known to the ordinary tourist. That it has exceptional charms to offer to the angler, the antiquarian, the historian, and the seeker of picturesque beauty is amply set forth in Mr. M'Connochie's interesting little book. It is rich in all the lore of the district, its Jacobite stories and romance, and ought to popularise the attractions of Donside.

Allgemeine Kartenkunde. Ein Abriss ihrer Geschichte und ihrer Methoden. Von HENRI ZONDERVAN. Mit 32 Figuren im Text und auf 5 Tafeln. Leipzig: B. G. Teubner, 1901. Pp. vi + 210. *Price* 5 *M.*

Petermann says, "The map is the basis of geography," and the Germans certainly realise this truth and act upon it. It is only in Germany that any literature of cartography exists, for it is only in Germany that it seems to be appreciated and studied, and it is extraordinary how extensive it is. The present work is of the nature of a general summary of the subject. The first part consists of a sketch of the history of cartography, tracing its evolution from the works of Anaximander of Miletus, 600 B.C., and Ptolemy down to the surveys of the present day. The author then proceeds to discuss modern maps generally and the methods of their production. He follows their construction through the various stages, from the survey to the projection, the drawing, engraving, and printing. The numerous notes and bibliographical references form a most valuable feature of the work.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE TEACHING OF GEOGRAPHY.

Globes, Discs, and Reliefs.

By M. Elisée Reclus.

The teaching of Geography, without which all other studies lack the vital element which is their visible, tangible, and ever-changing framework, can be effectively performed in its concrete reality by the observation of nature alone.

The subject of the first lessons, of those whose effects are most durable and of the greatest consequence in the spiritual and moral development of the child, is to show directly the Earth in all its cosmical connections and physical aspect, in its daily, monthly, and yearly movements. We make the child attentive to the succession of days and nights, to the course of the seasons, with their alternation of heat and cold, of winds and calms, of storms, rains, and droughts, to the flow of the waters, that never-ceasing force perpetually engaged in the sculpture of the landscape.

This method of teaching, from which are derived at the same time health and enjoyment, can unhappily be practised but little in our large cities, standing so to speak apart from nature, but the shortest walk outside the walls of the school may be utilised by the teacher to show to his young friends, for the benefit of their instruction, the agents actually at work, were it only the form of passing clouds or the ever-changing forms of sand and mud deposits which are shaped by the wind and the rain in the street gutters.

Even if those who study Geography were able to travel all over the Earth and to study every one of its mysteries on the very spot where it is best observed, they could not do without a model of our planet. They must have some concrete frame, in which the result of their

researches may be classified and the undisputed facts recorded. They must be able to localise their impressions and knowledge, have a clear idea of the relative position of the forms and distances of all the parts of the Earth, and have the means of comparing the countries they have heard of with those they know.

That representation of our planet cannot be anything but a sphere, exactly shaped like the large spheroidal ball which carries us in space. No map on a flat surface, however carefully drawn, can take the place of a globe. It is impossible to give to a plane figure the character of truthfulness, which a representation of the Earth must have, especially for children whose inquisitive minds cannot be satisfied by technical explanations of the projection of maps.

Before a globe there is no feeling of mystery. The child, who must naturally be bewildered by a map of the whole world on a single sheet of paper, understands at first sight a globe in which he sees a simple reduction of the large globe of which he has been told.

Thus a globe, upon which each hundredth of a millimetre represents a kilometre on the earth's surface, is unmistakably the figure of our earth to the scale of one to one hundred million (1 : 100,000,000). While our planet is 40,000 kilometres in circumference, that tiny reproduction is only 0·4 metre; nevertheless, on its curve the continents keep their real aspect; forms are respected as well as directions, distances, and proportion of areas. Harmony of nature is not modified in any way, and study is rewarded with immediate comprehension.

Before a map representing on the flat a large area, confusion of thought is inevitable, and impressions are wrong; and they are wrong in proportion to the extent of area of which the map is supposed to give a drawing. The reader remains perforce misled, especially when the map deals with distant countries whose form he is not familiar with. The very map which ought to be his guide deceives him, and, worst of all, he cannot know what is the nature of the errors which he has to correct. He consequently and naturally lapses into indifference towards the diversely shaped reproductions put before him. Knowing that he cannot get one truthful map, he does not care what forms he looks on. One method of projection enlarges the central part of the map, another the outlying districts, a third one draws out the peninsulas as if they had been passed through the rolling-mill, a fourth will, on the contrary, spread them, as if every part of the Earth surface were a sheet of elastic matter which could be at will pulled out or shrunk in all directions. In the study of every map it would be necessary to take into account the error introduced in every one of its parts by the projection of the network; but however accustomed to mental calculation, however well trained in the study of maps, the reader cannot help being influenced by the foreshortened outlines which he considers. The image kept in one's mind is always wrong, and sometimes the very geographer who is most accustomed to map-reading is the person whose brain is most helplessly muddled as to forms of natural features.

Therefore it is first for the sake of truthfulness that the representa-

tion of the planet must be done in the form of globes and not in the form of flat maps. A second advantage offered by the spherical figure is the character of unity. The common practice of studying one's own country on large-scaled maps and distant countries on much smaller scaled and proportionally incomplete maps keeps alive in the reader's mind delusions which the scientist shares too often. The Swiss, the Belgians, the Dutch must study the hard facts of statistics to realise that another country, whose map they have never seen in a larger size than the one of their native land, is really ten or a hundred times larger. On the curved surface of a globe no mistake is ever possible. The areas are to be seen side by side, and at the very outset comparison is made in the mind with sufficient accuracy.

There is no possible doubt: the spherical form is the one which must be used at first in teaching; but beyond a certain scale globes become very awkward implements by the space they claim. Sheets of paper can be piled up or bound together, a set of drawers can contain hundreds and thousands of them, but globes, even small, claim a definite space, and are, moreover, generally complicated with stands and circles, which make them cumbrous instruments at the best. That explains how globes have fallen into disfavour. The making of globes, which was more common than is generally believed at the time of the great geographical discoveries and during the two following centuries, has been now for many years almost confined to the production of globes rarely more than one foot in diameter.[1] The celebrated sphere of Martin Behaim (now in the library of Nürnberg) which Columbus saw, and on which he clearly perceived how his voyage could be accomplished, is bigger, its diameter being 52 centimetres (20½ inches), which after all is a very small thing.

As Ovid said:

"Stat globus, immensi parva figura poli."

Truly our world is immense, the representation is very small, nevertheless is it sufficient to sum up all human knowledge and to leave in the mind of the children a final impression of truth.

We must not forget that such skilful artists as Olearius and Coronelli built terrestrial and celestial globes of far greater dimensions, but these big monuments, having 3, 4, and up to 5 metres diameter, were not looked upon as instruments of teaching, but simply considered as curios for the decoration of palaces.

It is only in our own days that the usefulness to science of large-sized globes has been understood. In some future period globes of

[1] Globes of the most famous builders during the sixteenth and seventeenth centuries:—

Builders.	Diam. in mm.	Diam. in inches.	Circumference in m.	Scale.
Mercator (dedicated to Granville),	411	16·2	1·291	31,038,408
Florent,	329	13·0	1·034	38,774,425
Blaeuw,	340	13·4	1·068	37,518,782
Coronelli,	325	12·8	1·021	39,251,649
Hond (Hondius),	356	14·0	1·118	35,833,660
Hond Junior,	557	21·9	1·750	22,902,667

large dimensions and of rigorous detailed construction, at the scale of 1 : 1,000,000, or 1 : 500,000, or even 1 : 100,000 will not unlikely show their spherical dome in the parks of our large agglomerations, and be possibly disposed in such a way that the general aspect of the whole and the local study of the detail may be permissible. Considering the powerful resources of modern industry and the general trend of public opinion, we have the greatest hope that the erection of such a wonderful construction—one day a necessary part of the scientific outfit of every large centre—will be attempted at no very far distant date. Meanwhile our schools must be satisfied with very modest spheres; an ordinary limit will be the scale 1 : 20,000,000, giving a sphere of two metres circumference—in some special cases spheres for teaching purposes may reach the scale 1 : 10,000,000—4 metres round the equator, and only in the large halls of our universities could globes at the scale of one to the million be constructed—globes having nearly 13 metres diameter. The scale 1 : 1,000,000 recommends itself in another way; it is the size which will allow the relief of the soil modelled to its true scale of being seen, perhaps not very conspicuously, but at least clearly: the Himalaya showing a ridge of 8 millimetres ($=\frac{1}{3}$ of an inch) above the valley of the lower Ganges.

These globes would have over old ones the advantage of being constructed according to a definite scale, a thing which was impossible before Picard, Maupertuis, and La Condamine had measured arcs of meridian, thus ascertaining the real size of the Earth. At the time of Mercator, the founder of modern cartography, the Earth's circumference was still evaluated at 5400 German leagues, nearly 50000 kilometres of our day, or at a quarter more than measurements proved it to be.

As we cannot take spheres of big dimensions into our rooms, why should we not cut such balls into fragments easy to handle? If a real globe be divided, the parts could not be all of the same shape, but by allowing overlapping of contiguous pieces, they might all be extended into equal-sized, preferably circular, discs. A globe to the scale of one to 10,000,000 can in that way be replaced by, say, forty discs of the ordinary size of flat maps, discs having the same external form, the same size, and the same curvature, and which therefore can easily be piled up or bound in an atlas. We get thus a complete one-scaled atlas taking the place of so many maps with as many different scales or without any possible scale. In the same way the globe showing the Earth's surface to 1: 5,000,000—a larger scale than is ordinarily used for countries outside of Europe—would give an atlas of about 150 globular maps of usual size. From these 150, 10 perhaps would not yet be mapped, as belonging to Antarctic regions. Each disc overlapping its neighbour all round the circle, no earthly point can be left unrepresented. Perhaps three-fifths of these 150 discs would represent sea-regions, and might be classified apart.

It has been said with reason from Gerard Mercator that he had been the providence of pilots. Thanks to his charts, imagined in 1569, the mariner could draw a straight line between his starting-point and

his destination, read the course (direction), and sail away with the help of stars and compass. In our days, when great circle sailing has been inaugurated together with the introduction of steam, the globular discs may play the same *rôle* in relation to time-saving sailing, as did the maps of Mercator to the navigation of former days. We have, it is true, the gnomonic charts, issued by the Hydrographic Office of the U.S.A., on which every great circle-sailing track shows as a straight line, but course and distance can only be got by an elaborate process, whereas globular charts would give, with the help of an appropriate ruler, track, course and distance at a single glance.

The advantages of a globe cut thus into fragments would be exactly the same as those of a whole globe ; the circular sections have the same character of truth and unity ; it would only be needed to adjust them side by side, taking overlapping into consideration, to reconstitute the globe in part or in its entirety. To our mind it would be a very fitting decoration for our public halls to see such discs hanging on the walls, as did shields in the bygone age of war, discs showing in the midst of blue oceans the curved surface of the big continental masses from Europe to the unknown Antarctic. The geographer might have then full right to compare the beauty of his work with that produced by artists, painters, sculptors, or ceramists.

Obviously there is nothing new in the idea. In all times there have been proposals made to represent different countries by means of rounded surfaces showing the exact curvature, and giving thus at least an approximate idea of their true surface, compared with that of the Earth. In some museums, we can even admire the splendid map of Signor Pomba, which shows so beautifully the relief of Italy, from Sicily to the summit of the Alps. But up to now these reliefs can only be got at high prices by means of moulds and casts.

New industrial methods, however, give to the geographer the means of bending a disc of metal, cardboard, or celluloid to the exact mathematical curvature required by the scale, and to have on that disc a perfect engraving printed according to the best rules of cartography. Any number of copies can be obtained in that way. The price of the raw material will be higher than that of paper ; but, on the other hand, it has the great advantage of being far less sensible to atmospheric changes of dryness and dampness, and the draughtsman who works on a map to be printed on a spherical disc will be inclined to do it with a care correspondingly greater, as the printed surface is less perishable.[1]

As soon as the scale of the map on the curved surface is large

[1] The discs are circular portions of a sphere to the required scale extended into a square by a flat border ; the map is drawn, engraved, and coloured on the flat as usual, then printed on flat sheets of metal. These sheets in turn are submitted to a powerful pressure in a mould specially devised by Mr. E. Patesson, which brings them to the required shape without the slightest crease. One of the interesting points in that mechanical action is the regular modification which the network undergoes. When drawn on the flat, its deformation must be foreseen, so as to come out on the bent metal as portions of perfect great circles and of parallels, intersecting everywhere one another at right angles.

enough for the curvature to be perceptible to the eye, the cartographer is confronted with another geographical problem: he has to show the relief, pimples and dimples of the terrestrial orange, not symbolically, not by contour-lines, hachures, or scales of colours, but directly through an actual relief absolutely proportioned to the exact form of nature.

I take it to be an absolute rule that the relief must be given at the same scale as the map which is used as base, or in other words, the scale must be the same for horizontal and vertical lengths. Any relief which cannot be shown without exaggeration had better be left unrepresented, because any departure from the general rule will lead to misunderstandings and errors. False impressions are the more lasting, as they are partly based on a more scientific basis—a beautiful relief, the vertical scale of which is exaggerated in a certain proportion, will mislead for ever the cleverest scientist.

Our museums and schools of geography are already rich in beautiful reliefs modelled on true scales. These reliefs deal with districts which their natural beauty or their historical development render especially interesting. Some districts of the Alps and Pyrenees, some islands like Porquerolles, Iona, Rügen, some volcanoes and peaks like Vesuvius, Teneriffe, Arthur's Seat, the environs of some capitals and of some pleasure resorts, have been built and carved with the greatest skill. But a complete series of reliefs representing methodically the portion of the Earth's surface which geometers have carefully surveyed and drawn, about one-tenth of the land above water, that work has not yet been begun. Nevertheless it must be done, if the teaching of Geography is ever to rest on the exact figure of the Earth, and not upon incomplete representation appealing insufficiently to the eye and to the intellect.

As I have already mentioned, the scale 1 : 1,000,000 is the smallest one at which reproduction of terrestrial relief can be attempted; a height of 1000 metres (= 3000 feet) will be represented by 1 millimetre on the artificial globe, even half that height will be sensible, especially so if the cast is lit by a horizontal light. Thus on a sphere of 40 metres circumference will be shown all the important orographical systems which form the general skeleton of the continents, also isolated peaks like Gibraltar, Athos, Ailsa Craig, would peep clearly above the level of the water.

Upon a globe or fragment of a globe, at the same rate as the scale increases, there increases also the evidence of terrestrial life. We cannot but feel this at the sight of the admirable work which Mr. Perron, the Genevan cartographer, has carved, the relief of the Swiss Alps from Mont Blanc to the Bernina, to the scale of 1 : 100,000, upon a length quite sufficient to make sensible the curvature of the Earth. In looking at it, it seems as if one could see the geological factors at work, the production of folds and faults, the erosion, denudation, and deposition, and so on. To that scale a large relief gives already the impression of nature itself. It is like travelling in an air-ship above the mountain-tops; under your feet you see combes, glens, valleys, and plains; you see long ranges and ridges stretching far away, suddenly interrupted in the distance and reappearing farther away along lines which the study of

the map had not led to suspect. In that solemn contemplation you participate so to speak with eternity; it is like seeing a portion of the Earth evolving out of the primitive mass under the action of the shaping elements which are still at work.

And the wonderful effects obtained by such scales are still increased in larger-scaled reliefs, 1 : 50,000, 1 : 10,000, and so on. Of course the modest parish school could not attempt to possess all these treasures, if they were to be obtained, as to-day, by long and costly processes which at the most can give a few specimens for richly endowed museums. But here also industry comes to our help. In the same way as we can provide spherical discs in an unlimited number of copies, we are given the promise of thousandfold and millionfold exact reproductions of terrestrial reliefs. Not a single classroom will be then without truthful images of the most beautiful regions of the Earth, of those where the most remarkable features are to be seen and the most interesting phenomena to be studied.

Thanks to these lifelike reliefs, which will be found everywhere and which every child will see, we shall return to the direct study of nature; the teaching of Geography will revert to the method with which it started. The child will draw his own and immediate conclusions from the very source of our knowledge—the contemplation and study of our mother Earth.

THE FIRST TOPOGRAPHICAL SURVEY OF SCOTLAND.

By C. G. Cash, F.R.S.G.S.

The recent publication in the *Scotsman* of two articles on the Ordnance Survey (September 18 and 25, 1900) has drawn attention to several matters of interest and importance in the history of Scottish Topography, and, among others, especially to the preparation and publication of the first topographical survey of Scotland. This great and notable work was executed during the last part of the sixteenth and the first half of the seventeenth centuries, and it seems strange that up to the present no adequate and accurate account of it has been published, nor indeed any account at all that is readily accessible to the general reader or to the student who cannot get to the limited publications of certain learned and exclusive societies. Possibly an adequate account cannot yet be written, for there is a lack of information in regard to several material points; but it should be possible to give an account that avoids any positive inaccuracy, and such an account I hope here to present.

The men to whose ability, energy, and devotion the survey was due have not received the recognition that is their right; and neither is there to their honour any memorial even in the hall of the Royal Scottish Geographical Society, nor are the manuscripts of their work treated with the care and respect that should be bestowed on such sacred relics. I propose in this article to collect what is known of this survey and of the men that made it, and so to point out the extent of the indebtedness of

the modern geographer to the six men who first produced a topographical survey of this country. These six men were TIMOTHY PONT, JOHN SCOT, ROBERT GORDON, JAMES GORDON, WILLIAM BLAEU, and JOHN BLAEU; of these, as the names indicate, the four first were Scotsmen, and the others Dutchmen.

There is a great contrast between the conditions under which this first survey was made and those under which its latest descendants and successors, the Ordnance and Geological Surveys, are being conducted. Nowadays the country is peaceful, the inhabitants are interested in the surveys and friendly to the surveyors, or at the worst look on them with unintelligent wonder; travelling is easy by road and rail; accommodation is in general readily obtained and comfortable—even "camping out" has its pleasant side, though some of the mountain work, especially in the preliminary stages, exposed parties of the surveyors to the severity of the elements. But the conditions of the first survey were far otherwise, and it may be well to get some idea of them. Scotland had then but recently passed through the troubles and disasters that marked the reign of Mary Stuart. The fierce turmoil and angry controversy of the Reformation movement were agitating men's minds and absorbing nearly all the national attention. And before the work of the survey was completed, the political contest had resulted in the Civil War and the execution of Charles I. Such a period seems as unsuited as one could possibly be for such a work as a topographical survey, and yet it was in this period and amid all this disturbance that the work was done. The greater is the credit due to the Scotsmen who carried it out, and the more the honour that we should pay them. Again, locomotion was a matter of no small difficulty, especially in the Highlands, where practically no made road existed: "If you'd seen these roads before they were made, you'd lift up your hands and bless General Wade." There should further be mentioned one other element of difficulty, and that is the sharp demarcation that then existed between Lowlanders and Highlanders. To-day the linguistic difference scarcely constitutes a difficulty, and is only a matter of interest and curiosity. But then Lowlanders and Highlanders had no friendly dealings together, and could not understand each other's speech; and the "wild Scots" were seen outside their highland fastnesses only when a raid was to be made on the cattle and crops of the Lowlanders. The difficulty, then, of the surveying of the highland portion of Scotland by a Lowlander would appear to be insuperable, and, indeed, was nearly so.

The idea of making a topographical survey of this country originated with Timothy Pont, the son of a famous reforming clergyman, Robert Pont, of whom a little may well be said, inasmuch as he was resident in Edinburgh, and took a notable part in the establishment of the Presbyterian form of church government in Scotland. Robert Pont was born in 1524 and died in 1606. He was by training both a lawyer and a minister of religion, and was the last person to combine the functions of a preacher and of a Lord of Session. In 1574 he was appointed to the second charge of St. Cuthbert's Church, and he spent practically the remainder of his life in the service of the Church in Edinburgh. In

1578 he was promoted to the first charge, and he was "relieved of the burden of ordinary teaching" in 1602. During the intervening twenty-four years he was five times Moderator of the General Assembly, and took a foremost place in the councils of the Reformed Church, his legal training making him specially useful. In 1584 he was one of the small band of ministers protesting against the Acts of Parliament regarding the jurisdiction of the Church, and had to take refuge a while in England. On his return he suffered a short imprisonment. He outlived his term of active service by four years, dying in 1606, and being buried in his own churchyard.

The children of such a man, born in such a time of national fervour, would not, one naturally expects, be lacking in energy and devotion; and Timothy Pont fulfils this expectation. It is to be regretted that only the most meagre information has reached us regarding this man's life and work, and even that little has been sadly distorted and mis-told by various writers. I shall endeavour here to state accurately what we know about him, and to distinguish between knowledge and surmise. The date of his birth is unknown, but it must have been soon after 1560, because in 1579 he became a student in St. Leonard's College, St. Andrews. His father was Provost of the Trinity College, Edinburgh, and used the influence of his position to secure for Timothy some of the income of the College lands. This was done in 1574, while Timothy was yet a schoolboy, and as an early instance of the endowment of research will meet with the approval of geographers. At St. Andrews, Timothy graduated in 1583, and in the same year received a confirmation of his grant of the Trinity College endowment. It has sometimes been stated that we have no knowledge of him for the next eighteen years. But there exists still a map of Clydesdale drawn by him and bearing the date 1596, and this suggests that this interval was given up to the topographical studies that have made his name famous. In 1601, one year before the retiral of his father, he was appointed to the ministry of the remote parish of DUNNET in the extreme north of Caithness. How long he stayed here is not known, but he was there in 1609, when he applied for a grant of 2000 acres of the confiscated lands in Ulster. And he was there in 1610, as is proved by his signature as witness to a document executed in that year. But he was not there in 1614, for another minister then held office in Dunnet. There is no record of his death, and but the one date to indicate when he was engaged on the noteworthy work of his life, the beginning of the first topographical survey of Scotland.

Of the actual making of this survey we have very little knowledge. The only original record of it is contained in a letter from Robert Gordon to Sir John Scot, dated 1648. This letter I shall present at length in a later part of this article. Here I shall content myself with saying that it attributes the undertaking solely to the self-devotion of Timothy Pont, specifically stating that he had no help from any patron; it notes the linguistic difficulty already referred to, and reports the other difficulties and dangers of the adventurous wayfarer among uncivilised people in a strange land. The survey having been more or less completed, Pont

could find no publisher, and died while awaiting better times. This last statement, I take it, refers to the period during which he was minister at Dunnet, my own view being that he made the survey before his appointment to the ministry, and that he drew his means of subsistence from the Trinity College lands.

Be this how it may, Pont died some time before 1625, as is proved by the next part of the story. This next part is by no means clear, for there is no record of how the next two actors in it, King James VI. and Sir John Scot, came to interest themselves in the matter. According to Gordon's letter, the manuscript maps left by Pont were not at all well cared for by those into whose hands they fell at his death. I shall be able a little later to report a case somewhat parallel to this. Presumably Pont's heirs did not understand that he had been engaged on a work of national importance, and the precious sheets were left to damp and vermin, and would soon have lost all their value, and even ceased to exist. But King James VI. learned of their existence, and, as became the "British Solomon," gave orders that they should be officially cared for. But the official caring for them only meant concealing them among the royal archives, and so preventing them from attaining their legitimate end, publication.

Then Sir John Scot appeared upon the scene. He was a landed proprietor, a Lord of Session, and a busy man in the affairs of the nation. He was born in 1585, and died in 1670. In 1606 he succeeded to the office of Director of the Chancelry, an office that had been held by his father and his grandfather before him. In 1611 he acquired the estate of TARVAT, to the south of Cupar-Fife, and called it SCOTSTARVET. When the trouble of the Civil War broke out, he was on the King's side, and as a result lost his judgeship when the Republican party triumphed. He was fined £1500 by Cromwell, but could not regain any of his offices. Apparently his fruitless negotiations gave offence to his own party, for even at the Restoration he was still kept out of office, and was further fined £500.

But our present interest in him is less as a statesman than as a patron of learning. His home at Scotstarvet seems to have been the resort of the literary men of his time, and he was in correspondence with the scholars of the Low Countries. How Scot became interested in the maps of Pont is not known, but Gordon tells us that Scot urged King James VI. to have them published, and undertook the superintendence of the work. There is no evidence to show when this occurred, but it cannot have been very long before the death of the king in 1625. Scot's duty became a twofold one: he had to find some one capable of revising, correcting, completing, and editing Pont's maps, and he had also to find a publisher able to bring them out in a fitting manner. The second of these he found in the firm of Blaeu in Amsterdam, and the first in Robert Gordon of Straloch, a member of the famous Aberdeenshire Gordon family.

Robert Gordon was born in 1580, and died in 1661. He was educated at Marischal College, Aberdeen, then newly founded, and is said to have been its first graduate. In 1608, at the time of his

marriage, he bought the estate of Straloch, a few miles east of Inverurie in Aberdeenshire, and here he continued to reside, even when, on the death of his elder brother in 1619, he succeeded to the family estate of Pitlurg. Robert Gordon was a man of some note in the political affairs of his time, and was concerned in the negotiations between Huntly and Montrose in 1639, when the latter was so strongly supporting the Covenanting cause against Charles I. It was some little time before this that he became actively engaged in the work of preparing Pont's maps for publication. We do not know how this was brought about, though it seems to have been in some way the result of Sir John Scot's action. Gordon was himself an enthusiastic geographer and an excellent cartographer, as is well shown by his manuscript work still extant, and he would probably need but little pressing to undertake the task. When he began the work is not known, but the earliest dated map by him, one of the Edrachilles district, is dated 1636. This makes Gordon fifty-six years of age, and his powers, especially those most needed in the close and fine work of cartography, were probably not at their best. Further, he had the full burden of a large family—he left seventeen children—and the cares of his estates, and was troubled by the politico-ecclesiastic strife that led to the Civil War. It appears that the national character of Gordon's undertaking was recognised by both sides in the struggle, for King, Parliament, and General Assembly encouraged and aided him. In October 1641 the king wrote him—here and in all transcriptions of such documents I modernise the spelling—"To our trusty and well-beloved, the Laird of Straloch. Charles R. Trusty and well-beloved, We greet you well. Having lately seen certain charts of divers shires of this our ancient kingdom, sent here from Amsterdam to be corrected and helped in the defects thereof; and being informed of your sufficiency in that art, and of your love both to learning and to the credit of your nation; We have therefore thought fit hereby earnestly to entreat you to take so much pains as to revise the said charts, and help them in such things as you find deficient therein. Which, as the same will be honourable for yourself, so shall it do us good and acceptable service. And if occasion present, we shall not be unmindful thereof. From our palace of Holyroodhouse, the eighth day of October 1641." This was not, as we have already seen, the beginning of Gordon's labours, though some have so understood it. It may very well have referred to the first batch of proofs.

When the opposition to the king had taken definite shape in the National Covenant of 1638, Gordon's work was of course much disturbed, as Aberdeen was under Huntly's influence, and we have already seen that Gordon was concerned in the political troubles. But in order to give him as much freedom as possible to devote himself to his topographical work, he was, by special instruction of the Parliament, exempted from the burdens that he would otherwise have borne, and in January 1646 we find him petitioning for a renewal of his exemption. He writes: "My Lords of Parliament, unto your Lordships humbly mean and show I, your Lordships' servitor, Mr. Robert Gordon of Straloch, that where in consideration of my pains and travail in revising and correcting the

charts of this kingdom, it pleased your Lordships to exempt me from the ordinary burdens of the rest of the subjects in Scotland, to the end I might the better attend thereupon, and be encouraged thereby to lend my best assistance for the perfection of so honourable a work, which albeit I have carefully gone about hitherto, and am ready to give a proof thereof to those who have the doing of the work of this kingdom, yet my former warrant is disregarded by the present commander, and I daily taxed in a heavy manner, whereby I will be discouraged and disenabled from prosecuting the intended work, except your Lordships provide remedy. Herefore I beseech your Lordships to take consideration of the premises, and to cause renew my said warrant and exemption in such a manner that it may be available for me, to free me from the warrants of commanders who have slighted your former commands, which will encourage me more and more to follow out the intended work, and to be ready at all occasions to obey your Lordships' commandment, and your Lordships' answer I humbly crave." This petition was answered thus: "St. Andrews, 28th January 1646. The Committee of Despatches having considered the supplication above written, do, upon the grounds therein mentioned, renew all former acts and warrants past in the supplicant's favour. And ordains all officers and soldiers punctually to observe the same as they will be answerable upon their highest perils. (Signed) JA. PRYMEROSE," and was duly acknowledged by the local authorities, "At Aberdeen, the second day of March 1646. The which day the several acts and warrants respective above written were produced before the Committee of War for the shire of Aberdeen, and being seen and considered by them, they acknowledge the same, and do recommend the aforesaid warrant to Col. Robt. Montgomerie, commander-in-chief. (Signed) Mr. THO. MERSER." But a little later in the same year the exemption had to be repeated in stronger terms. "To the Right Hon. the Committee of Aberdeen, or, in their absence, to the chief commander of any forces within that shire, These. Right Honourable, Since it hath pleased the Estates by two several acts to exempt Mr. R. Gordon of Straloch from all quartering or other public burden whatsoever, to the end he may more freely attend to perfect that work (recommended to him by the said Estates) of helping and correcting the several charts of this kingdom; it is most necessary that their intention in the premises be followed, tending so much to the weal of the public. And being informed that, notwithstanding of all the former warrants given him for his exemption, he is still vexed by some unruly people, contrary to the mind of the Estates, therefore we have thought fit seriously to recommend the said Mr. Robert Gordon to you, to the effect he may be sheltered by your authority from all public burden or injury whatsoever, conform to the aforesaid acts given to him by the said Estates, that thereby he may be encouraged to go on to the perfecting of that work so happily begun; which, as it will be acceptable, and tend to the honour of this nation, so shall it oblige us to remain your assured good friend. (Signed) CRAFURD and LINDESAY. Edinburgh, 2nd May 1646." The recognition of this document at Aberdeen is somewhat curt: "13th June 1646. The above-written letter produced by the

Laird of Straloch. (Signed) ERSKYNE, S.P.C." The General Assembly tried to help Gordon by ordering all parish ministers to supply him with accounts of their parishes, paying most particular attention to geographical matters—a "Statistical Account" in short. But four ministers only are noted as obeying this instruction, because the instruction carried with it neither rewards for obedience nor punishments for neglect.

Robert Gordon felt himself unequal to the whole task of editing the maps of Scotland, and associated with himself his son James, the minister of Rothiemay, a parish in Banffshire, just where the Deveron enters that county. James Gordon was born probably about 1615, and died in 1686. When Robert Gordon was making the earliest dated maps that we have of his, in 1636, James Gordon was graduating at King's College, Aberdeen. We thus have the pleasing spectacle of the father, just passing from middle age and feeling the burden of his years, assisted by his young, vigorous son, just entering upon manhood, and with a full share of ability and goodwill. James Gordon was the equal, or perhaps the superior, of his father in cartographical work, and the one finished specimen of his work still extant is remarkable for beauty and neatness of execution. This is his map of Fife, dated 1642, and is a duplicate of one drawn while he was visiting Sir John Scot. Of this map, or rather of the first copy of it, a curious story is told. The map was on its way across to Holland to be engraved and printed, when it was seized, along with the rest of the contents of the vessel, the *James Gibson* of Leith, by the men of Dunkirk, who carried on in general a privateer warfare or piracy. Sir John Scot brought all his influence to bear to secure its recovery, and apparently succeeded. But it happened that Robert Gordon had counselled James to keep a copy of it, and it is presumably this duplicate that we still possess. Sir John's letter about the matter says, "To the right hon. my much respected friend the Lord of Straloch, These. Right honourable, being resolved to see my friends in the Low Countries in this idle time for learning, the first rencounter I had at Campheir was that I heard that a Dunkirker ship had taken your son's chart of Fife from one of our ships of Leith called *James Gibson*, and then instantly I moved one of our countrymen, Mr. Trotter, to write to some of his friends at Ostend, where the captain then was, to persuade him to send it back to me; but it is feared we shall come to no speed, this people is so malicious against our country. You did wisely that caused your son keep a double of it, or otherwise all had been gone. . . . If ye think meet ye may desire your son to draw it over again, that it may be joined with the rest; and if ye will give me any business here, I shall strive to obey them, and testify ever that I am and shall remain your humble servitor. (Signed) SCOTTISTARVEIT. Campheir, 2nd September 1645." Besides assisting his father in the work of editing Pont's maps, James Gordon made several admirable and valuable drawings of great interest to antiquarians. Of these may here be mentioned his large view of the City of Edinburgh, views of Edinburgh Castle, Holyrood Palace, the Parliament House, and Heriot's Hospital, and a plan of the City of Aberdeen. In all these he displays a certainty and accuracy of draughtsmanship that gives quite exceptional value to his work.

Sir John Scot, as I have said, was in constant communication with the scholars of Holland. Here he made the acquaintance of one of the most famous of Atlas makers, William Blaeu of Amsterdam. Blaeu carried on one of the largest printing establishments in Amsterdam, and Scot had intrusted to him the printing of two volumes of poetry by Scottish writers, to which he had himself contributed pieces that received the compliments of the printer. Before this time the most famous Atlases were those of the pioneers ABRAHAM ORTELIUS (1570), and GERARD MERCATOR (1595). Each of these had issued a solid folio of maps of the world, but in each case the Atlas was contained in a single volume. William Blaeu, geographer, mathematician, and pupil of TYCHO BRAHE, undertook a similar work, but on a larger scale; and, laying under contribution all the best-known geographers of his day, began the compilation of that noble work that remains to us, monumental in conception, and for its day supreme in execution. In its earliest form this Atlas was probably contained in three stately folio volumes; the text was printed in bold, clear lettering, and the maps were admirable specimens of clean and elegant engraving, in most issues, though not in all, coloured, gilded, and decorated with illuminated coats-of-arms, to a degree of glory that would now be thought too ornate for a book so eminently prosaic and utilitarian as an Atlas. As William Blaeu and his son John acquired more maps, the Atlas was issued in a larger number of volumes, until in 1662 it reached what seems to be practically its final form, and was thereafter issued in eleven or twelve volumes. To these were sometimes added other volumes, bound in the same style, and containing plans and views of famous cities and scenes. This final issue, with or without the volumes of views, is the most familiar form of the Atlas; and in Edinburgh copies of it are to be seen in the Public Reference Library, the Library of the Royal Scottish Geographical Society, the University Library, and the Advocates' Library. The text was printed in several languages, for circulation in different countries, but no copy was printed in English; most copies are probably in Latin, then the common language of students.

Throughout the progress of the compilation of this Atlas, Blaeu was constantly on the outlook for suitable contributors, and it so happened that he was considering the possibility of getting maps of Scotland just about the time that Scot was under the necessity of finding an engraver and publisher for the maps prepared by Pont and the Gordons. The conjuncture was a fortunate one, and the outcome of it most satisfactory. After a somewhat extensive correspondence in regard to the matter, Scot himself went across to Amsterdam, and, the elder Blaeu having died in 1638, assisted John Blaeu in the literary part of the work of the Scottish volume, writing or dictating most of the descriptions that accompany the maps. Blaeu is emphatic in his praises of the ample and exact knowledge, the literary ability, and the unstinted devotion shown by Scot in this part of the work. "Tarvet," he writes, "crossed over lately from Scotland into Holland, and staying in this city of ours for a considerable time, . . . spent whole days in my house in writing and dictating things that might tend to illustrate the maps of his fatherland, with

such happy memory that, though without papers and books, he described the shape of districts, their position, their boundaries, their present and former owners, the produce of their soil, their cities, their rivers, and many things of this kind. That man seemed to me to be a very Scotland to himself, and to have grasped in his mind the form of its districts. How happy do I think that land in which those who are free from the cares of state thus devote themselves to philosophy."

The Gordons appear to have finished their share of the work, the preparation of the manuscript maps for the engraver, by the beginning of 1648, for that is the date of Robert Gordon's dedicatory epistle to Sir John Scot. The processes of engraving and printing took some time longer, and the Scottish volume, including some maps of Ireland, was not issued until 1654. It formed the fifth and latest volume of the form the Atlas had then attained. In the final form, first issued in 1662, the number of maps was much greater, and Scotland then formed the sixth volume of the set of eleven or twelve. The maps of the Scottish volume in the later issues are the same as those of the first one, except that a new map of Modern (seventeenth century) Scotland is substituted for the one originally issued, and that in several maps "wind-roses" and ships are inserted as decorations. The text also is nearly the same, a few paragraphs having been inserted in some places, and an entirely new description of Aberdeen and Banff, by Robert Gordon, added to the one previously given.

These volumes are large folios, bound in cream vellum enriched with designs stamped in gold. They present a dignified and handsome appearance, and are indeed a pleasure to the bibliophile. The Scottish volume contains fifty-five maps and descriptive text to accompany them. Of these maps, six are of Ireland, one is of the whole British Isles, in the style of "Ptolemy" maps, one is of Ancient Scotland, and one of Modern (seventeenth century) Scotland. The remaining forty-six are detailed topographical maps of districts of Scotland, frequently a river valley being taken as the topographical unit, and the islands being treated in much detail on eleven of the maps. The amount of information on these maps is not a little surprising—hills, streams, roads, towns, villages, and notable houses being inserted in large numbers, and with remarkable, though by no means absolute, accuracy. As a curious instance of inaccuracy, I notice that the positions assigned to Scotstarvet on the maps of Fife and of East Fife do not agree by about a mile. To illustrate the amount of detail given it may be stated that near Edinburgh, north of the Queensferry Road and between the rivers Almond and Leith, are shown LYTH, NEWHAUEN, WEIRDY, GRANTOUN, NETHER KRAMONT, OBER KRAMONT, NETHER BARTOUN, OVER BARTOUN, LAURENCETOUN, PILMUSE, MOORHOUSE, W. DRYLEY, E. DRYLEY, BONITON, WARESTO, CANONMILLS, INNER LYTH, and KRAIG. And this is but a fair sample of the detail that appears generally on these sheets. In places we find curious records of conditions now passed away; thus east and west of "KORSTORPHIN" Castle are plotted the two lochs, Gogar and Corstorphine, now no longer existing, but still quite obvious to the eye of the geologist, and still simulated by the low-lying mists of autumn. On the

other hand, though we can recognise Scotland's highest mountain in "Bin Novesh," the three next in height, Ben Muic Dui, Braeriach, and Cairn Toul, are omitted, and this although it is reasonably certain that Pont passed among the Cairngorms, and although the Gordons were Aberdonians.

Of the forty-six sectional maps, thirty-six are definitely stated to be the result of the labours of Timothy Pont; three, that of Scotland north of Glenmore, that of Aberdeen and Banff, and that of Braid Alban, are attributed to Robert Gordon; and one, that of Fife, is named as the work of James Gordon. It is probable that the maps of East Fife and of West Fife are by him also. That leaves four maps with no assigned authorship, that of Lothian and Linlithgow, that of Sutherland, that of Harris and Lewis, and that of the Orkneys and Shetlands. Eleven of the sectional maps are specifically dedicated each to some Scottish gentleman or nobleman of the time, and the later form of the map of Modern Scotland is similarly dedicated. Sir John Scot is honoured with the dedication of the last map, that of the Orkneys and Shetlands.

But Scot is honoured much earlier in the volume, for among the preliminary chapters prefixed to the actual geographical matter appears the letter, previously referred to, from Robert Gordon, dedicating the whole work to Sir John Scot. As no good translation of this letter is available, and as the letter itself contains the original record of the compiling of the Atlas, I present here a somewhat close rendering of it. As the Latin and French versions differ slightly, I have enclosed in square brackets passages in the Latin but not in the French, and in round brackets passages in the French but not in the Latin. "To that distinguished and eminent gentleman, John Scot, of Scot Tarvat, Director of the Chancelry of the Kingdom of Scotland, and Assessor in the Supreme Court. Now at length, after many labours, after the loss of much time, and after such troubles as the mind shudders to remember, our Scotland worthily shows herself, and, among the other countries of the world, assumes her place in the great and famous Atlas of John Blaeu, [who is so renowned and so far before all others in this department of knowledge], (for which all lovers of geography will be under eternal obligation to him). Nor is she, as so often before, drawn by her writers from mere hearsay, deformed by wretched fables, contracted on scanty sheets, and quite unlike her real self; but as that talented [young] man Timothy Pont, the originator of this work, left her in his papers, [the memory of which man, without the crime of the greatest ingratitude, neither can nor may be neglected]. For, with small means and no favouring patron, he undertook the whole of this task forty years ago; he travelled on foot right through the whole of this kingdom, as no one before him had done; he visited all the islands, occupied for the most part by inhabitants hostile and uncivilised, [and with a language different from our own], (whose language he did not understand at all); being often stripped, as he told me, by the fierce robbers, and suffering not seldom all the hardships of the dangerous journey, nevertheless at no time was he overcome by the difficulties, nor was he disheartened. But when, having returned, he prepared to publish the results of his labours,

he was defeated by the greed of printers and booksellers (who refused to supply the necessary funds), and so could not reach his goal. While awaiting better times, untimely death took him away (in the flower of his age). His heirs, to whom he left his maps at his death, being men without knowledge of such things, neglected the whole matter, and the maps, being kept badly and carelessly, worm- and moth- eaten, already were falling to pieces, and, fading away, were becoming illegible even to careful eyes. Then that most munificent Prince, James, King of Britain, being informed of these matters, gave orders that they should be purchased from the heirs, and published. But, alas! they went from bad to worse, for they fell into the hands of those whose purpose was to conceal them as though they were religious mysteries; and so again they lay hidden, though the keepers were changed. Then you, O famous man, born for the good of literature, regretting so great a loss, urged that they should be published; you took charge of the matter with especial care, and you inquired anxiously who could be got to assist in the production of this work, as yet incomplete. Wherefore not unsuitably may it be said of you what Ulysses said of himself in the strife about the arms of Achilles, 'His deeds are mine.' Indeed I may say, without fear of contradiction and without flattery, that without thee, thee only, the world would yet have seen nothing of these maps, and, though produced with such great labour by their first author, they would evilly have perished (without benefit to any one). I wish he had been fated to outlive his own works, and from them to draw the hoped-for honours and the due rewards, and not that I, as a substitute for him, should have laboured in this duty with abilities less than his. Conscious of my own weakness, I have greatly shrunk from this project. Truly, I had spent my life from my earliest years in these studies, yet I had no thought beyond my own personal pleasure, and did not intend to prepare anything for publication. There were not wanting hindrances: my numerous family, the cares of household, the diversion of my interests into other channels, my increasing years, my desire to live privately and free from public care, and the civil wars that now for so many years have troubled us, working mischief to all and sundry. I myself, living in the district where is the centre of all disorders, and suffering often to my own damage, though surrounded at your advice and request by all the safeguards that could be asked from the illustrious Senators of the Kingdom, have not felt safe, and do not yet feel safe, while still this disturbance continues. So, if anything at all faulty should appear in this edition, let it be held as due to the evil of the times, and not to my want of care. For it must be acknowledged that these labours, which demand leisure and equanimity, have fallen on most unfavourable times. Yet I wish it had been allowed me to unfold all the writings of our Timothy, [to drink them in with the eye] before they had known the hand of the engraver. There were many things to change, to add, to remove, which now await a second edition. Now whatever work is here, it is necessary that we should all say that it is yours, that you are the real parent and the true nurse; you brought these maps out of darkness: they were restored on your authority; you, as my fugleman,

dispelled from me the slothfulness of declining years, (and encouraged me to take in hand what I should not have ventured upon without your help). When I lay hidden in distant lands and far from home, you procured me the favour of great and renowned friends, who helped me, and by exhortation urged me to this work, [without whose assistance my mind would have despaired, nay, even now would be despairing]. Thus came to me certain times of peace, but if they had favoured me at my desire I intended to add many things which now I must leave to more fortunate minds. I do not fear that the keen intellect of my very vigorous friend, the renowned David Buchanan, will be lacking to the honour of his distressed country; and what studies he works out will in due time see the light; or if there are others, unknown to me, suitable for the work, there is hope that they will bring hither their contribution [with the honour of their names]. And if anything is lacking in the chorographical descriptions, while excuse should be made for my weakness, I have a son trained in these matters, who has now given a public specimen of his powers, with applause. Him I accept as my substitute, that I may receive my discharge. Nevertheless, I shall not desert my post while I have life. For the rest, having experienced now for so many years your friendship, useful and honourable to me, I shall (live and) die your [great lover], (obedient and very loving servant), Robert Gordon. Aberdeen, January 24th, 1648." The earliest issue of this letter was unsigned, and to the French issue by some mistake the initials I. G. were appended.

The set of maps is incomplete, inasmuch as it does not include a map of Perthshire or one of Angus. The district of Perthshire is, however, covered by other maps, Upper Perthshire notably by the map of "Braid Allaban." But of Angus no map was issued till some time later. In a letter to Robert Gordon, dated February 2nd, 1648, Sir John Scot thanks Gordon for the honour of the dedicatory epistle, and then continues, "The Earl of Southesk hath intention to send for Mr. James in the spring to draw the shire of Angus, and ought in reason to do so, seeing he lost Mr. Timothy's map, and I hope you will be counsellor of him to come, that the work may be the sooner perfected and brought to a wished end, and not be left defective in the want of so good a shire." This letter leaves it somewhat doubtful who lost Mr. Timothy's map, whether James Gordon or the Earl of Southesk. It may also be noted that among the manuscript maps that still survive there are sixteen dealing more or less with Angus. It seems that the proposed arrangement for the preparation of a new map of Angus was not carried out, for Blaeu did not issue such a map, and the Atlas is normally without one. After the destruction of Blaeu's place of business by fire in 1672, a map of Angus, with descriptive text, was prepared by Robert Edwards, minister of "Murrose," and published by Valk and Schenk in a style that matches the maps in the Atlas. Copies of this map are not common, but I find that the map without the text has been added to the copy of the Atlas in the Advocates' Library, and a somewhat small-type copy of the text without the map has been added to the copy in the Edinburgh University Library.

Of such a work as this Atlas some copies may be more interesting than others. I have in my possession a copy that is of very special interest in connection with the history of the preparation of the Scottish volume: it is the copy presented by John Blaeu to Robert Gordon of Straloch. This is an issue in five volumes, dated I. 1644, II. III. and IV. 1645, and V. 1654, and bears manuscript on the title-pages in Blaeu's handwriting, which with some variation follows this form:—"CLARISSIMO VIRO ROBERTO GORDONIO A STRATHLOCH, IN PERPETUAE SIGNUM AMICITIAE ATLANTEM HUNC D. D. J. BLAEU." By a refinement of courtesy the Scottish volume did not receive any such inscription, Blaeu's preface showing that in regard to it he considered Scot and Gordon the givers and not the receivers of favour. Robert Gordon has inserted at the beginning of this volume, in his own handwriting, his dedication to Charles, Prince of Wales, afterwards Charles II. Presumably he intended that this should be printed in the future new edition that he looked forward to, but apparently no printed copy exists. The dedication is of course in Latin, and I here offer a translation:—"To Charles, Prince of Wales, Duke of Rothesay, Earl of Ormond, etc., the eldest son of Charles, by the grace of God King of Great Britain, France, and Ireland, Defender of the Faith, and heir apparent of all his Kingdoms,—a prince powerful, of highest rank, of the greatest hope, and of noble disposition—Robert Gordon, in his own name and in that of those who in addition have brought their own contributions, humbly presents and dedicates these attempts to illustrate Scotland and all the islands that lie round about it and look to the authority of its crown; attempts undertaken long ago and with great spirit by Timothy Pont, before untimely death carried him away, and now rightfully wrought over again, with many interpolations, completions, enlargements, additions, and corrections, and with the descriptions added that were obviously desirable;—this posthumous offspring, and his own care in bringing it forward." In the University Library copy of this volume, again, I find this same dedication, also in Robert Gordon's manuscript. This I take to be the first draft, as there are changes made in the course of its composition, whereas mine is a clean copy without changes. To the University Library copy there is added this note by David Gregory, who was Mathematical Professor at the University from 1683 to 1691: "HANC ESSE NUNCUPATIONEM IPSAM QUAM HUIC OPERI A SE EXARATAM ET AD JOANNEM BLAEU TRANSMISSAM ROBERTUS ILLE GORDONIUS À STRALOCH MIHIQUE TRADIDIT ROBERTI FILIUS JACOBUS GORDONIUS ECCLESIASTES ROTHEMAYUS UT IN BIBLIOTHECA ACADEMIAE EDINBURGENSIS ASSERVARETUR NOMINE MEO ADSCRIPTO TESTOR. D. GREGORIE. MATH. P." Unfortunately this note is either incomplete or faulty in construction, and its exact meaning is not clear. It confirms, however, the genuineness of the document, which is also amply proved in each copy by the handwriting.

My own copy of Blaeu's Atlas ran a risk somewhat comparable to that of Pont's maps, for it passed into the hands of people who did not understand its value, and it probably escaped the fate of waste-paper by a mere chance. A friend of mine was present at the displenishing sale of an Aberdeenshire farmhouse some years ago. In the advertisement

of the sale there was no mention of any books, and so, when the sale reached the stage of "Kitchen Stuff," my friend was somewhat surprised to see handed out a pile of large folio volumes in soiled white vellum covers, and a roll of engravings. Though he knew nothing of old Atlases, my friend at once saw that the books and engravings were not "Kitchen Stuff," and he bought them for a trifle, and passed the Atlases on to me. In view of such an adventure, one would like to know whether Sir John Scot and James Gordon had similar copies, and, if so, where they now are. Also it may be worth while suggesting that there should be some record of the ownership and place of deposit of books, etc., of special interest. Is there no bibliographical society that could collect and make available such information?

Having now given this account of the history of the Scottish volume of Blaeu's Atlas, I may briefly comment on some bibliographical and historical errors that have been made in regard to it by previous writers. The chief authorities are: (1) Archdeacon Nicolson's *Historical Collection*, 1702; (2) James Man's *Introduction* to his projected *Memoirs of Scottish Affairs*, 1741, in which Nicolson's statement is copied almost verbatim; (3) Gough's *British Topography*, 1780; (4) The Spalding Club's *Miscellany*, 1841-42, and *Topography of Cunningham*, 1858. Unfortunately each of these contains material errors, and these errors are copied from book to book, and tend to become accepted as statements of fact. Thus too often the date of publication of the Scottish volume is given as 1662 instead of 1654. Nicolson says that Pont was employed by Scot to make the survey, and this statement is repeated by Man, by Gough, and in the *Miscellany*. But there does not appear to be any foundation for it, and it is directly opposed to Gordon's statement. Indeed, there is no evidence at all that Scot was acquainted with Pont, and it is not even known how the existence of Pont's maps came to the knowledge of King James or of Scot. Again, Nicolson makes the strange statement that "Gordon was much abused in the edition of 1655 by the publisher," and this has been repeated in the article on Gordon in the *Dictionary of National Biography*. But there was no edition of 1655, and certainly no terms used by Blaeu in reference to Gordon can by any possibility be supposed to be abusive; they are, indeed, very much the contrary. In the Introduction to the *Topography of Cunningham* there appears the curious statement that "the map of Mid-Lothian being dedicated to King James plainly shows it must have been engraved before that king's death." This reasoning sounds all right, but the facts are not as stated. The Atlas contains no map of "Mid-Lothian"; but it does contain one of Lothian and Linlithgow, and this map is not dedicated to King James, but to William, Earl Lothian. It is certainly difficult to see how the editor could have made the double mistake. Besides the errors already noted, the *Dictionary of National Biography* makes others. In the article on Pont it gives the date of the publication of the Atlas as 1668. In the same article it is said that Pont died between 1625 and 1630, and in the article on Scot the date is given definitely as 1630. I have already noted that after his death Pont's maps, by King James's orders, passed into official custody; and as King James died in 1625 it is evident that Pont must

have died at some earlier date, not improbably about 1614. In the article on Scot the same *Dictionary* says that Scot purchased Pont's maps after his death. This also is obviously contrary to ascertained fact.

The manuscript maps prepared for the engraver by the Gordons were sent to Amsterdam, and presumably perished in the fire at Blaeu's place of business. But the original sketch-maps of Pont and some duplicates of the maps of the Gordons remained in Scotland in the possession of James Gordon. According to Gough, when Sir Robert Sibbald, geographer to Charles II., projected a new geographical account and Atlas of Scotland, he received from James Gordon all the suitable material, cartographical and other, that remained in his hands. But Sibbald's proposal was not carried out, and on his death his collection passed by purchase to the Advocates' Library. Gough quotes a list of the maps, as supplied to him by his "ingenious and communicative friend, Mr. George Paton of the Custom House, Edinburgh." From this list it appears that the maps have since been rebound into the large folio volume in which they are now kept in the Library. It is much to be regretted that they did not receive a more intelligent and considerate treatment, for the mounting of them is by no means satisfactory or conducive to their good preservation. Many of them are mounted with folds, and every fold is, of course, a means of damage; and in some cases the maps are mounted back to back on a common sheet. The volume contains one hundred and seventeen maps, the work of Pont, the two Gordons, and a later cartographer, John Adair. Twelve of the maps are by Adair, and are quite easily recognisable by their style of workmanship, which is entirely different from that of the others. Five maps bear the name of Timothy Pont, two that of James Gordon, and five that of Robert Gordon, three of them, however, being statedly based on maps by Pont. Of the remaining ninety-three the authorship is not indicated, and is not in every case easy to determine. Many of them are obviously the work of Pont, but some may quite possibly be the work of the Gordons. In a large number of cases the maps are the surveyor's rough sketches, made and corrected on the ground, and sometimes apparently under difficulties from lack of materials. In looking at them I have been forcibly reminded of the straits Dr. Livingstone was reduced to during one of his later journeys in the lake district of the Upper Congo, when he wrote his diary on pieces of newspaper, using the brown juice of berries as ink. For Pont's ink often has the same brown, faded look, making it occasionally extremely difficult to decipher; and in several cases the amended map has been drawn over the lines of the first draft, so that at a first glance the map is a confusion of lines, requiring some care to disentangle. Other maps, again, have been worked over with a better ink, so that the corrected lines or names stand out legibly above the faded original draft. In yet other maps the workmanship is neat and clean, and speaks of more favourable conditions. Gordon says distinctly that Pont visited all the islands of Scotland; but among these manuscript maps there is not any of the Shetlands, nor of the Hebrides, though these appear in the Atlas, where of the eleven maps dealing with the islands nine are attributed to Pont.

It is greatly to be desired that these manuscript maps, unique and invaluable as they are, should receive the attention and careful treatment that is their due. At present, owing to the form in which they are kept, and the somewhat frequent handling that they receive, they are undergoing a process of slow but sure destruction. They ought to be arranged and mounted in some manner that would tend to their preservation: a detailed study of them should be made by some expert with a view to assigning each to its author; and, lastly, they should be facsimiled, so that the information on them, not all of which appears on Blaeu's maps, should be at the service of students of the history of Scottish topography, without the need for so frequent handling of the originals, and with the possibility of easy comparison with other sources of information. One looks to such a learned society as the Royal Scottish Geographical Society for a lead in such a matter, and possibly under its auspices and those of the Society of Advocates, some one may recognise that here is a piece of work worth doing, and, by doing it, at once confer a boon on students, and raise a memorial to the men to whose ability and energy we owe the First Topographical Survey of Scotland.

FRANCE AND THE PENETRATION OF THE CENTRAL SUDAN.

Introductory.

France has devoted much energy and enterprise within the last decade to the penetration of the Central Sudan. In the preceding decade there had been several important missions and campaigns, the aims and success of which received their meed of British recognition in the Anglo-French Convention, signed at London, 5th August 1890, by which was recognised the spheres of influence of France to the south of her Mediterranean possessions, up to a line from Say (or Saye), on the Niger, to Barruwa, on Lake Chad, drawn in such a manner as to comprise in the sphere of action of the Niger Company all that fairly belonged to the kingdom of Sokoto. French activity in the Western Sudan, begun by Faidherbe in 1854, was resumed in 1880 by Galliéni, who surveyed the route for a railway to connect the navigable Senegal with the Upper Niger. Several campaigns were conducted, by which France secured her position on the Upper Niger, and finally opened the way to Tombouctou. In 1883 the fortified post at Bammako or Bamakou was founded, and in 1888 a fort was built at Siguiri, at the junction of the Tankisso and the Niger. In 1888-90 Binger, starting from Bamakou, secured for France by treaty the territories between the Niger and the Ivory Coast. And in 1890-2 Monteil made a reconnaissance of the Say-Barruwa line. Starting from the St. Louis on 9th October 1890, he arrived at Tripoli on the 10th of December 1892, having passed through Kano and Zinder to Kuka, on Lake Chad, and thence through Bilma or Kawar and Murzuk to Tripoli.

The penetration of the Sudan from Algeria is associated with Trans-Saharan schemes. The definite proposal for a Trans-Saharan railway

may be regarded as dating from the work of Duponchel in 1878, and from the Commission that was appointed in July 1879. Three missions were occupied in 1879 studying the possibility of building a railway across the Sahara to the Sudan. These were directed by Choisy, Flatters, and Pouyanne respectively. A second mission was entrusted to Colonel Flatters. He left Ouargla on 4th December 1880, and the last news received from him was dated 21st January 1881. He had been sent with an insufficient escort in the belief that it was easy to enter into pacific relations with the Touareg, and met his death with some of his comrades in an ambuscade, on the 21st of February, at Bir-el-Garama or Tadjenout. Trans-Saharan schemes fell into disfavour under the shadow of this calamity. But the Algerian railway reached Biskra in 1888, and M. Foureau was occupied with his explorations in the south of Algeria.

When the Anglo-French Convention was framed in 1890, it was assumed by the British that the Say-Barruwa line was the accepted limit to the south of the French sphere in the Sudan. In 1893 an Agreement between Great Britain and Germany was signed at Berlin on the 15th of November, by which part of the southern shore of Lake Chad, the basin of the Shari, and other territories up to the borders of the Bahr-el-Ghazal, Kordofan, and Darfur were assigned to the German sphere. But a desire had been awakened in France to arrive at Lake Chad and the Central Sudan from the Congo coast. France had secured a footing there as early as 1839 at the Gabon or Gaboon, had taken effective possession in 1844, and founded Libreville, the present capital, in 1848. When De Brazza passed from the basin of the Ogowé into that of the Congo, he secured a footing for France. In 1887 the Ubangi or Oubangui became the eastern boundary of the French Congo, and the post of Bangui was founded in June 1889. About the end of 1889, a certain number of persons, deeming it necessary to take immediate action to increase and develop the African domain of France, organised at their own expense the expedition of Paul Crampel, the aim of which was to explore the region comprised between the Congo and Lake Chad, to conclude treaties, and to return by the North. This was the beginning of the Comité de l'Afrique française, which was founded in 1890. Crampel succeeded in making his way to El-Kuti (El-Kouti), the capital of Dar Rounga, in March 1891, but was shortly afterwards killed when on his way to Baghirmi (Baguirmi). The same Association sent Mizon up the Niger and Binue in 1890, organised the Dybowski mission in support of Crampel, and then the Maistre mission, which set out from the French Congo and returned by way of the Binue and Niger. It was these missions of Mizon and Maistre that enabled France to claim the territories in the basin of the Shari (or Chari) up to Lake Chad, which were accorded to her in the Franco-German Convention, signed at Berlin, February 4, 1894. Between 1895 and 1897, Gentil was occupied in developing a route from the Oubangui to Lake Chad, with a view to utilising the waterways. In April 1897 he succeeded in placing a steamer and two steel boats on the Gribingui, and founded two posts between the basin of the Oubangui and that of the Chari at Krébédjé and at Gribingui, now Fort Crampel. He then entered into amicable relations with Senoussi, the Sultan of Dar

Rounga, and on the 23rd August, having left a garrison of eighty-eight guns at Fort Crampel, he began his descent of the Chari. This voyage lasted four months. He returned to Gribingui on the 13th of December 1897, having made a reconnaissance of the course of the Gribingui and of the Chari up to Lake Chad, and concluded a treaty of commerce and protectorate with the Sultan of Baguirmi.

By the Anglo-French Convention of 21st March 1899 these territories were recognised as within the French sphere, and in the Anglo-French Convention of 14th June 1898 a modification was made of the Say-Barruwa line, by which the district of Zinder was accorded to France.

With this recognition on the part of Great Britain there was attained the great aim that had been dominating the policy of France in regard to the Central Sudan. That policy had been crystallised into the phrase, "la réunion sur les rives du lac Tchad des possessions français du Soudan, de l'Algérie et du Congo français." Thereupon several missions, geographical and political, were organised, the goal of which was Lake Chad, and the aim of which was the effective occupation of certain selected points in the immense domain of this African empire. The first expedition took the route of the Senegal. It was commanded by Captains Voulet and Chanoine, who left France in July 1898. Passing through Kayes on the Upper Senegal, they entered the basin of the Upper Niger, crossed the river near Say, and continued their march to the Chad through Damerghou. After the unhappy events that occurred in the vicinity of Zinder in July 1899, the aim of this mission was achieved under the leadership of Captain Joalland and Lieutenant Meynier. The second mission was the Foureau-Lamy, which set out from Biskra on 24th September 1898 for Wargla (or Ouargla), to cross the Sahara to Lake Chad. The third mission was the Gentil-Bretonnet, the aim of which was to arrive at Lake Chad from the French Congo by way of the Shari (or Chari). The general direction of this enterprise was committed to M. Gentil, who left France on the 25th of February 1899. His second in command, M. Bretonnet, had preceded him, having left in September 1898. Here it is necessary to notice another French expedition, the goal of which was Lake Chad. This was a private enterprise organised by the *Syndicat commercial du Tchad*. At its head were MM. de Behagle and Bonnel de Mézières, both of whom had been members of the Maistre mission. The former left France in the beginning of 1897, and the latter in May 1898. It was their aim to proceed through Baguirmi and Ouadai (Wadai), and gain the Mediterranean coast by way of Aïr.

The Foureau-Lamy Mission.[1]

For a quarter of a century M. F. Foureau has been devoting himself to the study and penetration of the Sahara. He is a savant; and throughout his many missions and reports science has been his chief concern. But as early as 1886 Duveyrier said of him that he was the man

[1] De l'Algérie au Congo français par l'Aïr et le Tchad. Communication de M. Foureau. *La Geographie*, 15 Décembre 1900.

Itineraries of French Missions to the Central Sudan.

best fitted to lead with success a mission from Algeria to the French Sudan. One lesson M. Foureau had derived from his many attempts to penetrate the Sahara, that it was necessary to have a strong armed support. He believed, however, that the mere possession of it would suffice and that there would not be much occasion to employ it. He was well justified in this belief by the experience of the recent expedition. The warlike Touareg Ahaggar did not even show themselves during the days that the Mission passed along the borders of their territory, while the attacks which the Mission did encounter were not at all formidable.

At the end of his last report of 1897 M. Foureau had said "Nothing can be done in the Sahara without sacrifices and without money. Let a Mecænas arise and the question will find immediately its solution." Happily a Mæcenas did arise in the person of M. Renoust des Orgeries, who bequeathed to the Société de Géographie a considerable sum, with the express wish that it should be devoted to the purpose of linking up the colonies of Algeria, the Senegal, and the French Congo.

Such in a word is the origin of the Saharan Mission, the leadership of which was intrusted to M. Foureau with the military collaboration of Commandant Lamy, who had gained much experience in the south of Algeria.

The Mission left Ouargla on October 23, 1898. It consisted of some 280 men and a convoy of 1000 camels. After crossing the great dunes, a rest at Timassinine, and a march in the northern Tassili, the final plunge into the unknown was made with the departure from Ain El-Hadjadj. Four days, memorable on account of the difficulties, were occupied in crossing the massif of Tindesset. The rest of the route past Tighammar and Ahelledjem was still mountainous but much easier. The first of January was passed at Afara, a spot dominated by the high southern scarp of the Tassili, where the frost was such as might well have led them to suppose they were in France. Then began the crossing of the mountainous region of Anahef, composed of quartz and granite, which consists of a succession of mountain ranges, rough plateaux, and river-beds full of rocks. In the middle of this zone they crossed the watershed of the Mediterranean and Atlantic basins, and then camped at Tadent, where a short but arduous excursion of five days, from the 20th to the 24th of January, was made to the well of Tadjenout, the scene of the massacre of Colonel Flatters and his comrades. From Tadent they soon gained the interminable plain which Barth well called the "sea of rocks," and the Touareg name for which is Tiniri. The surface consists of quartz gravel, strewn with blocks of granite, knolls, lines of hills, which are wild, bare, arid and beetling. There is no water, no vegetation. The camels carried, in addition to their ordinary load, some fodder for themselves and some wood for cooking. They dropped one after the other, soon to be added to the innumerable skeletons that dot this terrible track. It was a period of interminable marching, fatiguing and deceiving, of incessant travelling without ever arriving. At last they reached the well of In-Azaoua, which has taken the place of the celebrated well of Assiou (or Asiu), now dry. There it was found necessary to leave behind some of the loads, owing to the mortality among the camels and

to the arrival of a convoy with dates. A stone redoubt was built, to which the name of Fort Flatters was given, and there the loads were stored and a guard left over them of fifty men. In-Azaoua was the last link of connection with France. Here couriers arrived and thence the last messages were despatched.

A march of eleven days then brought them to Iferouane, the first village of Air, in the Irhazar (or Ighazar) valley, with but one well on the way at Taghazi. The country is mountainous, at times very rough, formed mostly of quartz, granite, and gneiss, often rounded and in enormous blocks. These massifs are intersected by broad river-beds, running towards the west, in the bottoms of which the vegetation is found. Game is plentiful, gazelles and antelopes. Iferouane is an unimportant village, built on the edge of the valley, with gardens and a small forest of palms. The inhabitants are Kéloui Touareg (Kel-Owi Tawarik), blacks, and their slaves. The chief, El Haj Muhammad, received them well. He had known Erwin von Bary. Soon after he presented his father-in-law, El Haj Yata, an old man of more than eighty years, but erect and hale, who remembered Barth, and had entertained Erwin von Bary for a good while as his guest. He resides at Tintaghoda, a village near Iferouane. M. Foureau himself was not unknown here by name and fame. He was shown one day a piece of carpet and asked if he recognised it. On answering that it had certainly come from Algeria, but that he was unable to assign to it a more exact origin, he was told that he had himself some years ago made a present of it to Guidassen, the Sultan of the Azdjer, who had sold one-half of it to the possessor. A chain of high mountains, named Timgué (Timge) or Tenguek, rises to the east of Iferouane; it consists of high peaks, abrupt, rugged, inaccessible, and bare, and is furrowed by deep, narrow valleys. These mountains assumed night and morning admirable colouring, and displayed an imposing and marvellous panorama.

A great effort was made to obtain baggage animals to make good the loss since leaving Algeria. But there were no camels; nobody brought any; the Kéloui nomads had cleared the country round about and kept themselves out of reach; and the villagers had few or none at all. Commandant Lamy therefore set out with their own animals to bring in the detachment at In-Azaoua, and after a journey of twenty-three days of much hardship on account of the great heat and the want of water, he returned to Iferouane, but he had been obliged to burn a great quantity of barter goods, cottons, and dates. Meanwhile, on March 12, a band of Touareg, 400 or 500 strong, made an attack on the camp at dawn, but two or three volleys proved sufficient to disperse and put them to flight, and make them leave some camels behind them. But provisions were now becoming exhausted: the purchase of millet and sorghum, which now constituted the main food, along with the flesh of sick camels, had become very difficult, as the supply comes from Damerghou, and the caravans were not arriving or keeping out of the way. Dry tornadoes were frequent at this period (March, April, and May), and the heat was great. As it was impossible to remain there much longer without incurring the risk of being starved to death, it

was decided to move forward with everything that the available animals could carry, and leave the remainder under the charge of part of the escort under the command of Captain Reibell. The sojourn at Iferouane had lasted ninety days. On May 26, after a march of fifty kilomètres, they reached the village of Aquellal, at the foot of one of the high and abrupt mountain ranges of Air, where the narrow ravines descending from the summits spread out into a wide river-bed covered with thickets of beautiful gum acacias. The camp was pitched on an isolated eminence, an island of granite blocks, which afforded them an impregnable position. The village was empty, having been abandoned by its inhabitants, who had taken part in the attack on the camp at Iferouane, under the leadership of their chief, a sort of marabout named El-Haj Musa. At this time there came to them a Targui of the Kel-Ferouane, a bandit or highwayman of the great caravan routes, with an offer of his services. With his aid several reconnaissances were made in the surrounding district, during which some camels, cattle, donkeys, and goats fell into their hands, belonging either to the people of the village or to tribes that had taken part in the attack at Iferouane. In the course of one of these reconnaissances, under the direction of Commandant Lamy, a part of the escort was attacked by a party of 700 or 800 Touareg. As on the former occasion they were put to flight by the first volleys, and left behind them a certain number of dead and some animals. Among the trappings of one of the slain was found a Koran, which contained some pieces of paper with shorthand notes, and must therefore have belonged to Erwin von Bary. On June 11, Lamy brought in the detachment from Iferouane. More goods and other baggage had to be burned both there and at Aquellal.

After staying a month at Aquellal the Mission resumed its march towards the south on June 23, and after a march of ten days it reached the village of Aoudéras. There they received friendly letters from several Kéloui chiefs, but could not obtain animals. The Sultan of Agadez sent a supply of food for sale, but begged them to continue their march to the south direct without passing through his capital. It was deemed best, however, not to accede to this request, and after a halt of seventeen days it was decided to proceed to Agadez. The route from Aoudéras passes first through mountains with a hard and rocky soil and some rather difficult passes; then appear some granite hills, much lower, and separated by valleys with beautiful vegetation, among which the dhum palm predominated. The country then becomes more and more open, and finally a plain, more or less covered with small gum acacias, in the midst of which is situated Agadez. There the Mission arrived on July 28, and pitched camp on some rising ground amidst trees, and beside a good well named Tinchamane. The town is rather dreary-looking. The site is considerable, but more than one half is covered with ruined houses. The buildings intact are of clay, and some of them have a second storey. A few houses affect some style; these belong to people from Touat and Tripoli. That of the Sultan has nothing remarkable about it, but it has an upper storey provided with small, regular windows. It is massive, and the projecting beams of the

different floors give it a savage, bristling appearance. Beside it is the mosque, the high minaret of which remains as it was in the days of Barth. A market soon sprang up at the gate of the camp, to which were brought some cattle, maize, plenty of sheep and goats, guinea-fowl, poultry, pigeons, ground-nuts, millet flour, dry cheese, beans, sour milk, and some excellent tobacco from Kano and Katschéna. The Sultan, his relatives and viziers were profuse in their promises of friendship, grain, camels, and donkeys, but the supply of millet for food was only from day to day, and was constantly obtained under the compulsion of threats. The French flag, however, was planted on the roof of the Sultan's house, and a promise was received that it would be hoisted on the appearance of any white before the town. Having obtained some camels and donkeys from the Sultan, and finding that his power and authority were limited and that the Kéloui territory was shared with other important chiefs, they decided to leave for Zinder. They set out on October 10 with a guide furnished by the Sultan. But after leaving Irhaine the guide lost his way or was purposely leading them round to the north. After an absence of ten days, therefore, they returned to Agadez. The second stay in Agadez led to no change in the attitude of the authorities. Strong measures were therefore deemed necessary, and it was decided to seize the two chief wells that supplied the town. Thereupon they obtained one hundred camels and some donkeys.

Finally they set out from Agadez on October 17, 1899, and by long and rapid marches traversed the district of Azaouakh and Tagama. Azaouakh is a desert zone, bare and arid, with knolls of reddish sandstone. Tagama, which signifies in the Touareg language forest, is everywhere covered with bush more or less dense, and bare patches here and there. In those treeless places and beneath the trees the ground is carpeted with gramineæ, of which the most abundant is named *karendjia* (*karenjia*). This is greatly liked by the animals, which eat it greedily. On the other hand it is a great plague to travellers owing to the invisible spikes with which the seed bristles. There is a good account of it by Barth, who devotes several pages to it. M. Foureau met with it everywhere, but for one or two places, as far as the Lower Chari (Shari). The scrub consists mostly of small or middling gum acacias, which are overtopped here and there by larger trees, especially by a leafy species of *Ficus*, which resembles a chestnut in appearance. Tagama is a very paradise for hunters. The quantity and multiplicity of the game is incredible. There were three or four varieties of antelope, wild boar, lions, partridges, guinea-fowl and others. Damerghou or Damerghu is much more open than Tagama, with small patches of wood and immense fields of millet. At Gangara, a large village of Damerghou, M. Foureau joined the detachment under Commandant Lamy, which had preceded the other by two days, and after passing through several villages they arrived at Zinder.

There they found a detachment of one hundred Senegalese, forming the garrison of the French military post. These men belonged to the Central Africa or Voulet-Chanoine Mission, and had been left there by Lieutenants Joalland and Meynier, who had proceeded to the Chad.

Zinder is a large and fine town, surrounded by high earthen walls, very thick at the base and pierced with seven gates. The site of the town is of very great extent. It contains houses, some of which built of clay recall the type of house at Djenne, so well described by M. Dubois, and others of straw. All are well built, and are each provided with a small courtyard surrounded with matting upheld by stakes. The palace of the *Serki* or Sultan occupies a large space: it is built of clay, but has not much artistic merit. What gives to the town its agreeable and happy look is first the diversity of form of its houses, the irregularity of the positions occupied by them, and finally the presence of trees and shrubs, some everywhere scattered at random, among which are *dimaka*, baobab and borassus. The whole of one part of the town is occupied by an agglomeration of great rocks and masses of granite, which rises higher than the walls, dominating the environs, and affording a beautiful view from the summit. Outside, not far from the walls, is the commanding site of Fort Cazemajou, the residence of the French Commandant, on a mound of huge blocks of granite. It formerly belonged to a great Touareg merchant, Mallem Yaro, who gifted it to France. He is a remarkable man, and rendered many services to the Misson. His own residence at present is at Zengou, a Touareg suburb of Zinder. In his house, which is also a warehouse, were found all kinds of European commodities. Through him M. Foureau despatched a courier with letters for France on November 3, 1899. Although they did not reach the French Consul-General at Tripoli by way of Ghadamis till October 23, 1900, the receipt of them is good evidence of the trustworthiness of this merchant and his agents. He also sent three of his relatives or agents with the Mission from Zinder to the Chad and to Koussri. In front of one of the gates of Zinder there is a market formed of regular buildings divided into shops.

During the period of their sojourn at Zinder, Commandant Lamy with half of the escort made an excursion toward Tessaoua and its neighbourhood, in order to bring to obedience the chiefs of that district who had become recalcitrant. After having brought these people to reason, and assured order in those parts, he returned to Zinder after an absence of thirty days. As he had collected either as tribute or as fines some 300 horses, and as a section of the Kéloui had furnished at Zinder 100 camels, the Mission was now in a position to continue its route. On arriving at Zinder M. Foureau had found a telegram from the Minister of Public Instruction giving him entire liberty to choose his route either by the Sudan or by the Congo. As his original instructions were to cross the Sahara to the Sudan, to follow the Sudan route to the Chad, to pass through Kanem, and finally effect a junction with M. Gentil on the Chari, M. Foureau did not hesitate but decided that it was his duty to continue his march to the East.

Commandant Lamy therefore set out from Zinder with the first detachment on December 26, and M. Foureau with the remainder of the escort under the command of Captain Reibell followed on December 29. They kept in touch, Lamy transmitting information as to wells and villages, and joined hands on January 9, 1900, at the

village of Adéber, to continue their march together. The country traversed contains some fine villages. The bush is very thin, with clumps of large trees and vast plains covered with tall grass, in which game was abundant. All along the route there were many ponds or small lakes, the waters of which were charged with carbonate of soda. These depressions are always surrounded by dhum palms. This district is called Manga. The natives are much occupied with the extraction of salt from the mud, waters, and crystallisations of these lakes. Impure as it is, it sells well, and is in much demand throughout a wide field of trade. The producers of the salt do not engage in agriculture, but exchange it for millet. From the village of Adéber, marching always across plains of tall grass dominated here and there by imposing tamarinds, they arrived at the Komadugu Yobe, in which there flowed a thread of water, and the banks of which were everywhere covered with a thick belt of forest. This river waters the important village of Begra, where they found Shaikh Ahmar Scindda, son of the former Sultan of Kuka, dethroned by Rabah, who accompanied thereafter the Mission. During this period rations were much reduced, as millet was difficult to procure in this country where the salt industry supersedes all agricultural work. All the villages encountered in the vicinity of the Komadugu river had been pillaged and burned by the bands of Rabah. Even Kuka, the former capital of Bornu, with its hundred thousand inhabitants, has not been spared, and is now nothing but an immense melancholy mass of ruins.

It was on January 21, 1900, near the village of Arégué (Arege) that M. Fourneau beheld the Chad for the first time. There the lake is fringed with reeds, but openings permitted a clear view of the expanse of water, on which the sunlight gleamed, and innumerable birds disported themselves. Along the border of high-water cotton is grown. Farther south, they marched along the shore of the lake where it had no belt of reeds. A pretty strong swell was visible, indicating a certain depth. The water is sweet and very good to drink. In the tract that stretches along the Chad to Kuka, and in the country to the north there is abundance of game. Elephants are there in great numbers, and showed themselves frequently. The route then followed round the shores of the lake, passing through Barroua (Barruwa), Woudi, and Neguigmi. This last village had its huts intact, but abandoned by the inhabitants on account of the frequent razzias of the Oulad Sliman (Aulad Sulaiman) and the Tubu. They touched at next the watering-place of Yarra and then at the village of Kologo. Throughout this part of the route, that is, along the whole of the north-west and north of the Chad, the scrub ends at the extreme limit of high-water, where it crowns a continuous chain of low sandy hills, which form, as it were, the banks of the lake. There, the ground is everywhere strewn with the remains of huge fish, the whitened bones of hippopotami, crocodiles, and elephants. Game swarms everywhere. One day, when a halt had been made, innumerable troops of antelopes galloped past between the lake and the camp, and occupied ten minutes in one unbroken line. Giraffes, rhinoceros, and lions also abound in the bush.

On the west shore they saw some canoes of the Boudouma, who dwell on the islands of the Chad. These canoes are made of bundles of reeds bound tight together; they are heavy but unsinkable, although those on board are seated more or less in the water. They are almost rafts, but are shaped like an ordinary boat; they have an elevated prow and terminate in a bundle of lashed canes. These Boudouma are nothing but robbers. They seize and reduce to slavery all stray persons, such as the stragglers of caravans, for whom they keep watch concealed among the reeds along the margin of the lake, and then sell them on the opposite shore.

Beyond Kologo the route took a sharp bend to the south-east. The open shore of the Chad was left farther and farther behind. Thereabout the shore is much indented. The lake is divided into several winding lagoons, some of which penetrate a long way into the land. These necessitated a wide circuit and occasioned much troublesome marching in and out and round about them. It was only at the villages of Néguéléoua that they beheld again the gleaming expanse of the Chad, which is there studded with islands.

Then they came to the district of Kanem, the principal oases of which lay to the east with their flourishing palm-groves. A slanting march then brought them to the village of Dégunémdji, which is not far from both Negouri and Mao. There they found Lieutenant Joalland awaiting them. He had received letters addressed to him by Lamy, and had come thither to meet them, with an escort of thirty horsemen, from his camp at Goulfei, on the bank of the Chari, which he had left in the charge of Lieutenant Meynier. A rapid march of five days brought them from Dégunémdji to the camp on the Chari, and thereby effected the junction with the Central Africa Mission.

The country through which they passed during these five days consisted first of level plains, covered with tall, dry reeds, which are inundated during the rainy season. Then they skirted some swamps or lagoons, fringed with tall reeds, and more or less obscurely connected with the lake. The plain then becomes undulating and diversified with patches of wood, above which rise occasionally large sycamores. The *teborny* was present in great numbers, and this tree was met with everywhere from the north of the Sahara to about 7 N.L. The natives use its bark when bruised as soap, and eat the kernel of its fruit, which has a somewhat bitter taste.

One district which was traversed is that which is marked Bahr-el-Ghazal on the maps. It is necessary to guard against supposing that there is a river of that name. It is not at all an affluent of the Chad as some have been fain to regard it, but simply a kind of lagoon or gulf, long and narrow, up which, according to the natives, the flood-waters of the Chad advance as much as sixty kilometres into the interior of the land.

Farther on the bush becomes thicker. The unbroken stretch of sward is covered with bushy thickets, above which rise here and there clumps of larger trees, mostly gao and tamarinds. Ant-hills are everywhere in crowds. The country is cut up by a number of dry channels

or depressions, the black soil of which is full of deep, wide fissures. It was evident that the whole of this tract is flooded in the rainy season by the overflow of the Chari and the many branches of its delta. Bush and plain, both of them are then very largely inundated, and marching would during that time be well-nigh impossible. The whole of this wooded tract is the haunt of all kinds of game, from guinea-fowl to rhinoceros, the latter of which is there in abundance.

Up at Goulfei the Chari is a very fine river; although it was the season when it is at its lowest its bed was of great width. They remained but a short time opposite Goulfei, and immediately afterwards made a halt of three days at Mara, a town on the bank of the Chari, where it was necessary to cross the river. This was easy enough for the men who were ferried across in pirogues, but rather difficult for the animals, which occupied two days, and some of which were lost. They found the town abandoned, and continued their march towards Koussri, a town of considerable importance, at the confluence of the Logone and the Chari. On the 2nd of March the Mission was encamped some kilometres from the town, which was strongly held by part of the troops of Rabah. During the night, Commandant Lamy led out the greater part of his troops into the bush, and at three o'clock on the following morning he took possession of Koussri after a brilliant assault, in which the enemy lost many men, arms, standards, and provisions.

Rabah either in person or by his lieutenants held Goulfei, Karnak-Logone and Dikoa. News the most diverse and varied was received each day, giving the most contradictory reports about the positions and supposed movements of the enemy. As soon as the Mission was installed at Koussri natives began to arrive in numerous crowds and camped around the town, fleeing from Rabah, and seeking as it were to put themselves under the protection of the escort of the Mission. Some 10,000 to 12,000, it was estimated, gathered around Koussri in the course of a month, and brought their herds and flocks with them to the number of about 15,000 head of cattle, sheep and goats. They all belonged to different tribes of Choua.

The Choua are a light-skinned people, widely distributed in distinct groups throughout Bornu and along the Chari. There can hardly be a doubt that they came originally from the east. Their own original language is Arabic, which they all know and speak more or less, although in their relations with the world in general they habitually make use of the speech of Bornu or Baguirmi. The women have beautiful figures and delicate features, and show little or no trace of negro blood. Their hair is long and is divided into a number of little round tresses; sometimes a longer tress is wound up into a coil at the back. They all wear round the hips under their clothes several strings of large white and blue beads. Some of them have as many as ten or twelve such chains of beads. It is easy to count them, for they do not put them off when they bathe, and they often have a plunge in the river.

The population of the towns of the Lower Chari—of Chaoui, Goulfei, Mara, Koussri, Karnak-Lagone, and some others—is composed of a race of people called Kottoko. Their colour is a deep black, and their hair is

very woolly. They are most of them ugly, more especially the women, but well made. Fishing is their sole occupation, in which they use nets, harpoons, and boats with nets. For this purpose their boats (pirogues) are extremely stable. They are some twelve metres long by 1 m. 50 to 1 m. 60 wide at the stern, where is the main beam; the forepart is very narrow and high, and runs up to a point. A large net, mounted on two large, outstretched arms, is placed at the stern, and is worked by means of a great lever, formed by a piece of wood at right angles. The net is let down till it almost touches the bed of the river: the boat then moves slowly along, while another smaller boat approaches the net, managed by two boys, who make a great ado, beating the water with poles and drumming on the sides of their little skiff. Then the net is raised and the haul tumbles of itself into the fishing-boat. As the rivers of the country are full of fish, the catches are generally good. To give some idea of the quantity of fish in the Chari, M. Foureau says that many a time as he ascended the river good-sized fish leapt into his boat, and he had just to put out his hand to seize hold of them.

Koussri is situated some twelve metres above the Logone, and the houses reach to the verge of the bank. They are well built of solid clay, with thatched roofs, which are supported by a framework of stout poles. They are generally rectangular in form, but occasionally they are cylindrical. Some of the former have an upper storey. Although the ceiling is pretty high a very small opening serves for a door. Often they have a court in front which surrounds two or three houses. Within are always found fixed bins for millet, which are a sort of high cylinder made of baked earth or clay. A great many of the houses of Koussri have bee-hives, which are arranged pretty much as among the Kabyles of the Aures. These bee-hives are basket-work jars, almost cylindrical, covered with a coating of clay; the neck, which is much more narrow, is placed along the wall opposite a little hole where the bees may go out and come in. Bee-hives are also found not only in the trees of the town but in large trees in the woods, throughout the whole country where wild bees are abundant, as along the whole course of the Chari and Gribingui. Honey is therefore a common article everywhere.

The Saharan and Central Africa Missions had already joined hands, but there remained to effect a junction with the Mission commanded by M. Gentil. Owing to the great distances to be covered, the unsettled condition of the country, and the slowness of native communications, M. Foureau had not yet been able to receive any answer to his letters from M. Gentil himself, but had heard from Captain Lamothe, who was at Masséré, a town of Baguirmi, not far from the old capital Massénya, and who formed with the men of his command the advance guard of the Gentil Mission, which was on its way down the Chari to the desiderated meeting. Meanwhile Commandant Lamy had sent Sub-Lieutenant de Chambrun with sixty camels to Captain Lamothe, in order to help him with his transport. News from them came to Koussri on the morning of the 2nd of April. Immediately Lamy decided to send to his assistance twenty pirogues in order to facilitate the descent of M. Gentil's convoy.

As the Saharan Mission had now accomplished its entire programme—Sahara, Soudan, Tchad, and Chari—its rôle had thereby come to an end. The escort of the Saharan Mission, as well as that of the Central Africa Mission, would thereafter be at the command of M. Gentil, the Commissaire of the Government, for any military operations which he might deem necessary to undertake. M. Foureau set out on his homeward journey the same evening along with the pirogues and an escort of thirty men.

It was on the 11th of April, at Mandjafa, that M. Foureau and M. Gentil met at last. Both men, as well they might, were deeply touched. M. Gentil, advancing through a country which is peculiarly his own, which he discovered and made known to the world, beheld a fellow-countryman who had set out from the Mediterranean to join hands with him on the Chari. That handshake was not the mere meeting of two Europeans in the heart of Africa: it was symbolic of the soldering of the last link in the French chain which was stretched across the entire African continent.

M. Gentil kindly put at M. Foureau's disposal an escort of six men, two pirogues, paddlemen, supplies, and a guide—a particular friend of Sultan Gaourang (Gaurang), who had in 1898 paid a visit to Paris. On the 14th of April M. Foureau resumed his ascent of the Chari, while M. Gentil resumed his descent of the same to Koussri. On his voyage up the Chari and Gribingui, which lasted fifty-six days, M. Foureau had with him M. Villatte and the four Chambba of Ouargla, who had so bravely and faithfully served him since leaving Algeria. This period of navigation was very monotonous. Each evening they camped on a sandbank, which precaution, however, did not prevent the paddlemen deserting from time to time. It then became necessary to procure new men at the villages along the river, and the recruiting was always a laborious job. It was then the season of low water, and at times it was necessary to haul the pirogues over the shallow places, more or less long. The rate of progress was extremely slow and permitted the Chambba to land for a hunt and then rejoin the party or even go ahead and re-join upstream. Each day two or three antelopes were bagged according to the need for viands, game literally swarmed along the course of the Chari, and as the tall grass was everywhere burned at that season the animals were very easily seen. Then began the rainy season, accompanied by tornadoes, raising into great waves the waters of the river, obliging them to seek shelter beside the banks. On these occasions, as soon as the pirogues were alongside the bank, during the rain the paddlemen would jump overboard up to the neck and cover their head with an inverted calabash, remaining philosophically in this attitude till the storm passed. The reason for this spectacle is quite simple: the temperature of the water in the river would be about 30° (86° Fahr.), while that of the rain would only be about 24° (75° Fahr.). The natives immerse themselves to avoid a chill. Besides innumerable hippopotami, crocodiles, and antelopes, there were numbers of lions, which were heard at night if not much seen; rhinoceros were abundant. As for elephants there were whole districts of them along the Chari. One night, when camped on a sandy island, there was a

whole troop of them, some two or three hundred metres from the camp, where they remained for upwards of two hours disporting themselves.

A short time ago there were large, fine villages along the banks of the Chari, but all these have been destroyed by the troops of Rabah. The population, Baguirmi in some cases and Bornu in others, of the lower and middle Chari have departed into the bush. Only some villages of straw huts remain on the banks and more frequently on the sandbanks. These are all temporary and belong to fisher-folk and are submerged during the season of high water.

The Chari, even at this period of low water, is a very fine river, the bed of which is very wide. During the season of high water not only does it become a majestic stream, attaining at some points a width of 6 to 8 kilometres, but it overflows on either side the neighbouring plains and forms for a while innumerable lakes. The ultimate banks at a distance are marked by tall bush, which assumes a tropical aspect little by little the farther south. Only one station has been established on this river, that of Tounia, which is called Fort Archambault.

On leaving the Chari proper and ascending its affluent, the Gribingui, the scene changes. This river is much narrower, and does not exceed 60 metres at its mouth, and is only 20 metres higher up at the station of Gribingui. Its course is made up of several sections by a succession of rapids, which at that time carried very little water and necessitated some troublesome haulage. But at high water these rapids disappear and give place to violent eddies where the current dashes against the great blocks of submerged rocks and there acquires great swiftness.

The bush, with bare spaces here and there, which borders the river, is enlivened by great numbers of birds and monkeys, while the underwoods conceal herds of deer. Rocky, precipitous banks and sharp bends, often crowned with forest, give to the landscape a varied and attractive appearance. The river is literally strewn with fishing-weirs. These are occasionally a great hindrance, as they often obstruct the whole current. The natives choose large trees on the margin for felling and throw them across the river, thus barring the current. It only remains for them to make some gaps in the submerged branches and insert there some large nets. These traps were a great temptation to the paddlemen, and it was necessary to intervene at once in order to prevent them from paying a visit and appropriating the contents. On the upper course of the Gribingui suspended bridges were met with, which looked picturesque. Making use of two large trees on the banks, the natives unite them by long and strong lianas, join these lianas by other lianas, weaving a sort of large net shaped like a V, which serves both for bridge and parapet.

At Gribingui M. Foureau abandoned the pirogues and took to the overland route of about 300 kilometres. He was mounted on an ox, and the baggage was carried by porters. There it was the rainy season: the grass was green and tall; and in that region during that season no one can say that he is ever dry. After a journey without incident they arrived at Kemo—Fort de Possel—on the Oubangui. From that point first pirogue and then steamers conveyed them to Brazzaville. From

Bangui, M. Foureau had the company of M. Bonnel de Mezières and of M. Mercuri; the former from the sultanates of the Bahr-el-Ghazal, the latter from the Haut Oubangui (Upper Ubangi) and Senoussi (Senussi).

In concluding, M. Foureau gives in a few words his personal impression of the countries through which he passed. As regards the Sahara, the mountains and forests of the Sahara are pleasant from the points of view of form, of colour, of light and of atmosphere, while the equatorial zone, so melancholy, sombre and deceiving with its enormous forests, which mask the horizon, oppresses and depresses as if one were eternally plunged in the atmosphere of a cave devoid of light. He is therefore more in love with the Sahara than with the high forests along the banks of the Oubangui and the Congo.

On former occasions when addressing the Geographical Society of Paris, M. Foureau always concluded by saying "au revoir," as he was unable and unwilling to credit any arrest to his march towards the south, but on this occasion he said "adieu," deeming his work terminated and his life's aim achieved.

This account of his Mission and its work is derived from the communication which he made to the Geographical Society of Paris at a meeting held on December 5, 1900, in the amphitheatre of the Sorbonne for the reception of the Saharan Mission. It will probably awaken in some an earnest desire for the speedy appearance of the full narrative of this memorable expedition, and its geographical and scientific results. It will suffice to say that M. Foureau executed a route-survey of his whole itinerary, took 512 astronomic observations for ascertaining the position of the principal points, and made a collection of geological specimens which give an idea of the stratigraphy of the regions traversed. This work will be eventually published, together with that relating to meteorology, botany and ethnography. M. Foureau and his companions, and also the Geographical Society of Paris, may well be congratulated on the remarkable success of this historic Mission.

(To be concluded.)

GEOGRAPHICAL NOTES.

EUROPE.

The New Harbour (Victoriahavn) in Norway.—The Consul-General of the U.S.A. at Frankfort, in a Report dated February 28, gives some details from German papers of the new harbour that is being constructed in the north of Scandinavia. Its chief purpose is to provide shipping facilities for the immense quantities of iron ore found in Lapland. The iron mines of Gellivare and Luossovaara have been developed to such an extent within the last ten years that better facilities for the export of the ore have become an urgent necessity. The new harbour will be named Victoriahavn, and its entire northern shore of more than half a mile will be used exclusively for the shipment of ore produced

in the above-named mining districts. The Government of Norway has bought an extensive tract along the south side of the harbour. The harbour is being constructed after the plans of Duluth. The total cost of the docks and buildings is estimated at £160,000; the cost of the docks proper at about £130,000. The plans for the new city to be built here are nearly completed; many houses are built and some streets laid out already. Of late new iron deposits of enormous extent have been discovered in Lapland, and steps for developing them have been taken. A daily production of 5000 tons of ore is expected. Some of these claims have been bought by a Belgian company; while several English and German experts have lately been exploring this region for iron and other minerals, and important discoveries are said to have been made. The laws of Norway are very favourable for mining enterprises, as the discoverer of a mineral deposit on public lands is at once entitled to exploit it. All he has to do is to give notice of his discovery and have such notice registered.

ASIA.

Tea and Coffee Production in Annam.—The year 1894 was the first in which tea from one of her colonies was offered in France. In that year 7500 pounds were received from Annam. In 1896 the receipts jumped up to 10,296 pounds: in 1897 to 13,000 pounds. In 1898 the imports of tea from Annam into France were 42,262 pounds. The estimate for 1899 was not less than 140,000 pounds.

Up to 1892 Annam tea was cultivated only for use among the natives, and the proposition to cultivate it for European consumption seemed a chimera. But the consumption of tea in Europe was increasing very rapidly. From 1,447,635 pounds consumed in 1892, the quantity rose to 1,794,832 pounds in 1898, and it is believed to have increased by nearly another 100,000 pounds in 1899. The supply was almost entirely from China and Ceylon.

This tea from Annam is said to equal the finest article produced in China. It is in very good use in the French army in Annam, and it is believed to be only a question of time when it will fill the entire demand in France. The production is daily increasing. The old colonists are going into the business of raising tea, finding it more profitable than any other occupation.

New Railways in the Caucasus.—According to a report of the U.S.A. Consul at Coburg three new railway lines have been planned or are already under construction on the eastern and north-eastern shores of the Black Sea. The first line is to join Novorossiisk to the Caucasus Railway and will start from the Vladikavkaz line, cross the mountain chain by the Maikop route, and proceed along the coast down to Sukhum Kale. This line is to be only 28 miles in length, but its continuation to Novo-Senaki, on the Trans-Caucasian Railway, will shorten the route from Rostov to Tiflis by 450 miles. The new standard-gauge railway, moreover, would open up a number of Government coal-mines. The second line is to start from Tiflis and pass through the wine-growing districts of Kakhetia. The third project concerns the mines of Sadonsk and the metallurgical districts of Alagir, in the northern Caucasus, which are reported to be very rich in argentiferous lead and zinc ores. The railway is to start from Vladikavkaz, and will traverse the country of the Terek Cossacks.

Central Asiatic Railway.—It is officially announced, says the U.S.A. Consul at Coburg, April 26, 1901, that the old wooden boat bridge over the Amu Darya, near Charjui, will be replaced by an iron bridge 5000 feet in length. The new structure is to be built in such a way as to prevent the river from shifting the

foundations of the bridge. According to the plans published, there are to be twenty-four piers, each about 185 feet apart. The total weight of the structure will be 5190 tons, and the estimated cost is upwards of £500,000.—*U.S.A. Consular Reports, July* 1901.

The Population of the Philippines.—The origins and relationships of the peoples of the Pacific have been discussed ever since the discovery of the islands of the South Sea. The inhabitants differ so widely in physical and mental qualities that it was obvious to the earliest navigators that here very distinct races were mingled together; and islands and tribes were named, by Magellan and his successors, according to the appearance of the peoples. The inhabitants of the Philippines were classified in two groups, the Negritos and the Indios, possibly because the former were supposed to have African and the latter Indian affinities. It is, however, in the highest degree improbable that African negroes should have colonised the Pacific islands in the sporadic manner which the present distribution of the Negritos would indicate; and it is generally supposed that the latter are the primitive inhabitants, now in many cases driven to the unhealthy and inaccessible interior, and that the lighter-coloured Indios are later immigrants who have settled on the coasts. This view is supported by the affinities of the language of the lighter races with that of the Malays.

The problem has, however, become complicated by further discovery, which has defined the areas in which the two racial types respectively predominate: the blacks inhabit the western area, including Australia, New Guinea, and the larger archipelagoes, while the peoples of lighter colour are spread over the islands of the north and east; and thus the old distinction of Melanesia and Polynesia is found to answer to an apparent ethnological division. Professor Virchow, in an able *résumé* of the evidence on this question,[1] is of opinion that, in the absence of historical information on the matter, we must hold, not only that the Negritos and Indios are genetically distinct, but also that the widely differing groups into which each of these is divided are separate groups. The contrary conclusion is that of Theodor Waitz (*Anthropologie der Naturvölker*, vol. v., who denies that there is a primitive black race as distinguished from the lighter peoples, and believes that the whole population derives from one race of unusual variability. When such opposite points of view are maintained by these high authorities, we are not surprised that "not a few have returned from the South Sea with the conviction that all criteria for the diagnosis of men and of races are valueless."

The study of the ethnic relationships of the light-coloured peoples of the Philippines is complicated by the great number of tribes. No fewer than fifty-one of these, in addition to Negritos, Chinese, and whites, have been enumerated by F. Blumentritt (*Petermann's Mitteilungen*, 1882), who classes them all as Malays, chiefly on linguistic grounds. But it is pointed out by Virchow that the identity of language among all the tribes has not been established, that in any case a foreign language may be imposed upon a people to the annihilation of their own, and that "the Malay Sea is filled with islands on which tarry the remnants of peoples not Malay."

"For a long time," says Professor Virchow, "especially since the Dutch occupation, these old populations have received the special name of Alfuros. But this ambiguous term has been used in such an arbitrary and promiscuous fashion that latterly it has been wellnigh banished from ethnological literature. It is not

[1] *Sitz. d. k. Preus. Akad. d. Wissensch. z. Berlin*, 1897, translated with notes by Professor O. T. Mason for the Smithsonian Institution, and published in advance in *Popular Science Monthly*, July 1901.

long ago that the Negritos were so called. But if the black peoples are eliminated, there remains on many islands at least an element to be differentiated from the Malay, chiefly through the darker skin colour, greater orthocephaly, and more wavy, quite crimped, hair. . . . One cannot read the accounts of travellers without the increasing conviction of the existence of several different, if not perhaps related, varieties of peoples thrust on the same island.

"From this results the natural and entirely unprejudiced conclusion, which has repeatedly been stated, that either a primitive people by later intrusions has been pressed back into the interior or that in course of time several immigrations have followed one another. At the same time it is not unreasonable to think that both processes went on at the same time, and indeed this conception is strongly brought forward. So Blumentritt assumes that there is there a primitive black people and that three separate Malay invasions have taken place. The oldest, whose branches have many traits in accord with the Dayaks of Borneo, especially the practice of head-hunting; a second, which also took place before the arrival of the Spaniards, to which the Tagals, Visayas, Vicols, Ilocanes, and other tribes belong; the third, Islamitic, which emigrated from Borneo and might have been interrupted by the arrival of the Spaniards, and with which a contemporaneous immigration from the Moluccas went on. It must be said, however, that Blumentritt admits two periods for the first invasion. In the earliest he places the immigration of the Igorrotes, Apayos, Zambales—in short, all the tribes that dwelt in the interior of the country later and were pressed away from the coast, therefore, actually, the mountain tribes. To the second half he assigns the Tinguianes, Catalanganes, and Irayas, who are not head-hunters, but Semper says they appear to have a mixture of Chinese and Japanese blood.

"Against this scheme many things may be said in detail, especially that, according to the apparently well-grounded assertions of Muller-Beeck, the going of the Chinese to the Philippines was developed about the end of the fourteenth century, and chiefly after the Spaniards had gotten a foothold and were using the Mexican silver in trade. At any rate, the apprehension of Semper, which rests on somewhat superficial physiognomic ground, is not confirmed by searching investigations. So the head-hunting of the mountain tribes, so far as it hints at relations with Borneo, gives no sure chronological result, since it might have been contemporaneous in them and could have come here through invasion from other islands.

"The chief inquiry is this: Whether there took place other and older invasions. For this we are not only to draw upon the present tribes, but, if possible, upon the remains of earlier and perhaps now extinct tribes."

Professor Virchow describes certain skulls brought by Dr. Jagor from a cave near Lanang on the east coast of the island of Samar, which depart widely from the characteristics of other Philippine specimens, and suggest most the Kanaka crania from Hawaii and Maiori crania from Chatham islands. These are, he concludes, the remains of a very old, if not autochthonous, pre-historic layer of population.

AFRICA.

Touat and Tombouctou.—Touat (Tuat or Twat) is the general name for the territory which comprises the three principal districts: Gourara to the north, Touat proper to the south of Gourara, and Tidikelt to the east and south-east of Touat. Although Tidikelt is the most sparsely populated it exercises a kind of supremacy over the others; its principal centre is In-Salah, which is an important depôt for the caravan trade between Algeria and the Sudan. The most southern of the oases of Tidikelt is Akabli or Acabli, from which two large caravans set

out every year for Tombouctou. The first caravan starts in the beginning of April, and arrives at Tombouctou at the end of May. It remains there during the warm months, sets out again at the beginning of October, and reaches Akabli towards the middle of November. The second caravan does the reverse. It leaves Akabli at the beginning of October, and returns in May. Thirty-five days suffice for the journey, but the caravan takes a little longer because of the necessary days of rest. The halting-places are known, and are fixed with regard to their resources of water, shade, and forage.

The goods transported to the Sudan are: Manufactured iron goods, guns, side-arms, draperies, and hardware from Germany; of English stuffs, printed calico, cotton goods, and muslins; of Italian goods, glass-ware, "burnous," and "gandouras"; of French products, lace, thread, needles, utensils, sashes, paper, soap, tobacco, knives, arms, corals, essences, iron and copper wire, medicines, etc.; also dates and salt.

The products of the Sudan which go north include ostrich plumes, ivory, tanned hides, gold dust, and basket-work; slaves also are sent. The caravans employ for this trade an average of 9000 camels.

The value of the export business, not including the trade in slaves, is estimated at about two million francs.

AMERICA.

Railways in Colombia.—According to official information there were 605 km. (376 miles) of railways in the Republic of Colombia at the end of 1900. In the Department of **Antioquia** there is a constructed line of 68 km. (42 miles) long from Puerto Barrio, on the Magdalena river, to Caracoli. This railway is being built by the Departmental Government of Antioquia, assisted by the National Government, and is destined to reach Medellin, capital of the Department and a centre of much commercial importance. The length of line as surveyed between Puerto Barrio and the city of Medellin is 190·37 km. (118 miles). It has already been constructed beyond Caracoli, but that city is the present inland terminus of operations. The main office of the company is at Medellin. In the Department of **Bolivar** there is a railway 107 km. (66 miles) long between the city of Cartagena and the port of Calamar, on the Magdalena river, constructed and operated by the Cartagena-Magdalena Railway Company. In the same Department a railway 45 km. (28 miles) in length connects the city of Barranquilla with Puerto Colombia or Sabanilla, through which port the ocean shipments of Barranquilla are made. In the Department of **Cauca** there is a Government railway 40 km. (25 miles) in length, running from Buenaventura, on the Pacific Ocean, to San José. This line is intended to reach the city of Cali, 138 km. (86 miles) from Buenaventura. The work of construction is proceeding, but it is not expected to be completed to Cali before the expiration of about seven years. This line already renders very valuable services, and its importance will be very considerably increased when it shall have reached the last-named city, the heart of the rich valley of the Cauca. In the important Department of **Cundinamarca**, in which is Bogotá, the capital, there are four railways in operation. The Savanna Railway, between Bogotá and Facatativá, is 40 km. (25 miles) in length. Passengers and freight between Bogotá and the Atlantic coast make use of this line; it forms an indispensable link in the chain of communication, and is the property of the National Government. The Northern Railway connects Bogotá and the city of Zipaquirá, where are located some of the most remarkable salt-mines in the world. Its length, as constructed and in operation, is 60 km. (37 miles). An extension of this line to the Magdalena river, at a point well below Honda, is perfectly feasible, and would be the beginning of the solution

of the transportation problem between the city of Bogotá and the Atlantic coast. The Southern Railway, between Bogotá and Soacha, has a completed length of 11 km. (7 miles). The Girardot (or Jirardot) Railway is in operation from the port of that name on the Upper Magdalena river to Juntas de Apulo, a distance of 40 km. (25 miles). It is designed to terminate at Bogotá, making a total length of line of 155 km. (96 miles). The work of construction has already been effected as far as Hospicio, and would have been carried farther if the war had not interfered. In the Department of **Magdalena** there is a railway 67 km. (41·6 miles) long, extending from the city of Santa Marta, on the Atlantic coast, to the Sevilla river; it is designed to terminate at El Banco, on the Magdalena river, a distance of 375 km. (233 miles). In the Department of **Panama** there is the Panama Railway, between Colon and the city of Panama, 78 km. (48 miles) in length. In the Department of **Santander** there is the Cucuta Railway between San José de Cucuta and Puerto Villamizar, on the Zulia river, on the Venezuela frontier, 55 km. (34 miles) long. In the Department of **Tolima** there is the Ladorada Railway, between Ladorada and Arrancaplumas, 34 km. (21 miles) in length. This line belongs to a British corporation, and was built to avoid a dangerous stretch of river navigation in the vicinity of Honda, Arrancaplumas being in fact a suburb of Honda. The Tolima Railway, which has 3 km. (1·8 miles) constructed and in operation, is intended to connect the important city of Ibagué with the port of Girardot, 60 km. (37 miles) distant, on the Upper Magdalena river; but there are no indications of an early resumption of work on this line of railway.

The **Pearl Islands** of Colombia, in the Bay of Panama, 50-60 miles SE. of Panama, consist of Del Rey, San Jose, Pedro Gonzales, and many islets. For upwards of a hundred years this small group of islands has been famous for a remarkable yield of pearls and coral. During certain seasons of the year, when the waters are unusually clear, these waters are worked by divers, and many pearls of great value have been found there. The pearls rank well in grade and colour; in the latter respect, they range from the pure white to green and lead grey, and frequently jet black. These fishing-grounds have been a source of great revenue to the Government, as well as to the few more fortunate finders. Some little expense is attached to the business, as it is necessary to have experienced divers and men thoroughly versed in the business. It is estimated that the shell of the oyster, commonly known as the mother-of-pearl shell, if trimmed and shipped to Europe or the United States, would be sufficient to defray all ordinary expenses, and leave the find of pearl as a clear profit. It is not common to have valuable finds, yet the fisher is sometimes rewarded with pearls of great worth. Some two years ago, a small boy, while diving in the shallow water more for sport than work, found a pearl, which he sold to a local dealer for $4000 silver ($1760). This dealer delivered the same pearl to a buyer in Panama, and received $10,000 silver ($4400) for it. This pearl is now in Paris, and an offer of $6000 gold has been made therefor and refused. Formerly, those who worked in these waters paid a percentage on their finds; later, an annual tax. It seems that now the Government has decided to sell the exclusive right to the highest bidder for a period of fifteen years.—*U.S.A. Consular Reports, June* 1901.

AUSTRALIA.

The Australian Trans-Continental Railway Scheme.—Arrangements for the survey of the proposed trans-continental railway from Port Augusta at the head of Spencer Gulf to Kalgoorlie (W.A.) are complete. Surveyors' parties from each state are to meet at Eucla on the great Australian Bight. The South Australian

Government favoured a more northerly route, but it has yielded to the wishes of West Australia and agreed to a concentration of surveyors' parties at Eucla. The country to be surveyed is some of the very worst in all Australia. The crystalline limestone plateau north of the great Australian Bight is probably the only portion of the continent in which aboriginal tribes absolutely do not exist. Even in the great West Australian Desert, Warburton found numerous aboriginal inhabitants. It will be remembered that it was across this country north of the Bight now to be surveyed for the proposed railway that Eyre made his ill-advised but heroic and, at last, solitary journey in 1840-41.

The Ethnological Expedition into Central Australia, under Professor Baldwin Spencer of Melbourne University, is pursuing its work. The expedition has been on the Alberga river, where the Professor secured phonographic records of some of the corroboree and sacred songs of the Arunta tribe. At Alice Springs cinematographic pictures were obtained of corroboree dances and sacred ceremonies. The expedition has now gone farther north among the Kaltish tribe, and will also spend two months on Tennant's Creek amongst the Wardaminga natives. The expedition started with twelve months' supplies. Professor Spencer reported in passing Lake Torrens, that this lake, which is generally a mere glistening sheet of salt overlying a bed of half-dry mud of vast extent, is now, after the recent heavy rains, covered with water, and under strong winds waves break in spray on the miniature cliffs that bound it. Lake Eyre lies some few feet below sea-level, and is the lowest point of the great inland basin.

ANTARCTICA.

National Antarctic Expedition.—The following instructions, signed by the Presidents of the Royal Society and the Royal Geographical Society, have been communicated to the Commander of the Expedition and to the Director of the Civilian Scientific Staff. In place of Professor Gregory, resigned, Dr. George Murray, F.R.S., Director of the Botanical Department of the British Museum, has been appointed Director of the Civilian Scientific Staff. Dr. Murray will not proceed farther than Melbourne or Lyttelton with the *Discovery*, but on the voyage out he will, in concert with Captain Scott, the Commander, appoint a principal member of the Scientific Staff who shall carry out the scientific work on the lines laid down by the Director. On the return of the Expedition he will, as Director, be the editor of the scientific results.

The following is the list of officers of the Expedition :—Commander Robert Scott, R.N., Commander ; Lieutenant Armitage, R.N.R., second in command ; Lieutenant Royds, R.N. ; Lieutenant Barne, R.N. ; Lieutenant E. H. Shackleton, R.N.R.

The following are members of the Scientific Staff :—Dr. George Murray, F.R.S., Director ; Dr. R. Koettlitz, Mr. Hodgson, Mr. E. A. Wilson, Mr. William Shackleton, Mr. R. Skelton (*Engineer*). A geologist will be appointed to do the geological work which would have been done by Professor Gregory, but will not otherwise have Professor Gregory's position.

Instructions to the Commander.

1. The Royal Society and the Royal Geographical Society, with the assistance of His Majesty's Government, have fitted out an Expedition for scientific discovery and exploration in the Antarctic Regions, and have intrusted you with the command.

2. The objects of the Expedition are (*a*) to determine, as far as possible, the nature, condition, and extent of that portion of the South Polar lands which is included in the scope of your Expedition; and (*b*) to make a magnetic survey in the southern regions to the south of the 40th parallel and to carry on meteorological, oceanographic, geological, biological, and physical investigations and researches. Neither of these objects is to be sacrificed to the other.

3. The scientific work of the executive officers of the ship will be under your immediate control, and will include magnetic and meteorological observations, astronomical observations, surveying and charting, and sounding operations.

4. Associated with you, but under your command, there will be a Civilian Scientific Staff, with a Director at their head. A copy of his instructions accompanies these instructions to you.

5. In all questions connected with the scientific conduct of the Expedition you will, as a matter of course, consider the Director as your colleague, and on all these matters you will observe such consideration in respect to his wishes and suggestions as may be consistent with a due regard to the instructions under which you are acting, to the safe navigation of the ship, and to the comfort, health, discipline, and efficiency of all under your command. Those friendly relations and unreserved communications should be maintained between you which will tend so materially to the success of an Expedition from which so many important results are looked for.

6. As the scientific objects of the Expedition are manifold, some of them will come under the immediate supervision of the Director and his staff; others will depend for their success on the joint co-operation of the naval and civil elements: while some will demand the undivided attention of yourself and your officers. Upon the harmonious working and hearty co-operation of all must depend the result of the Expedition as a whole.

7. The Expedition will be supplied with a complete set of magnetic instruments, both for observations at sea and on shore. Instructions for their use have been drawn up by Captain Creak, R.N., and yourself and three of your officers have gone through a course of instruction at Deptford with Captain Creak and at Kew Observatory. The magnetic observatory on board the *Discovery* has been carefully constructed with a view to securing it from any proximity to steel or iron, and this has involved considerable expense and some sacrifice in other respects. We therefore impress upon you that the greatest importance is attached to the series of magnetic observations to be taken under your superintendence, and we desire that you will spare no pains to ensure their accuracy and continuity. The base station for your magnetic work will be at Melbourne, or at Christchurch, in New Zealand. A secondary base station is to be established by you, if possible, in Victoria Land. You should endeavour to carry the magnetic survey from the Cape to your primary base station south of the 40th parallel, and from the same station across the Pacific to the meridian of Greenwich. It is also desired that you should observe along the tracks of Ross, in order to ascertain the magnetic changes that have taken place in the interval between the two voyages.

8. Geographical discovery and scientific exploration by sea and land should be conducted in two quadrants of the four into which the Antarctic Regions are divided for convenience of reference—namely, the Victoria and Ross Quadrants. It is desired that the extent of land should be ascertained by following the coast lines, that the depth and nature of the ice cap should be investigated, as well as the nature of the volcanic region, of the mountain ranges, and especially of any fossiliferous rocks.

9. A German Expedition will start at the same time as the *Discovery*, and it

is hoped that there will be cordial co-operation between the two Expeditions as regards magnetic and meteorological observations, and in all other matters if opportunities offer for such co-operation. It is understood that the German Expedition will establish an observatory on Kerguelen Island, and will then proceed to explore the Enderby Quadrant, probably shaping a course south between the 70° E. and 80° E. meridians, with the object of wintering on the western side of Victoria Land, whence exploring sledge parties will be sent inland. The Government of the Argentine Republic has undertaken to establish a magnetic observatory on Staten Island.

10. You will see that the meteorological observations are regularly taken every two hours, and, also, in accordance with a suggestion from the Berlin Committee, every day at Greenwich noon. It is very desirable that there should, if possible, be a series of meteorological observations to the south of the 74th parallel.

11. As regards magnetic work and meteorological observations generally, you will follow the programme arranged between the German and British Committees, with the terms of which you are acquainted.

12. Whenever it is possible, while at sea, deep-sea soundings should be taken with serial temperatures, and samples of sea water at various depths are to be obtained, for physical and chemical analysis. Dredging operations are to be carried on as frequently as possible, and all opportunities are to be taken for making biological and geological collections.

13. Instructions will be supplied for the various scientific observations; and the officers of the Expedition will be furnished with a manual, prepared and edited by Dr. George Murray, on similar lines and with the same objects as the scientific manuals supplied to the Arctic Expedition of 1875.

14. On leaving this country you are to proceed to Melbourne, or Lyttelton (Christchurch), New Zealand, touching at any port or ports on the way that you may consider it necessary or desirable to visit for supplies or repairs. Before leaving your base station you will fill up with live stock, coal, and other necessaries; and you will leave the port with three years' provisions on board, and fully supplied for wintering and for sledge travelling.

15. You are to proceed at once to the edge of the pack and to force your vessel through it to the open water to the south. The pack is supposed to be closer in December than it has been found to be later in the season. But this is believed to depend rather on its position than on the time; and the great difference between a steamer and a sailing vessel perhaps makes up for any difference in the condition of the pack.

16. On reaching the south water you are at liberty to devote to exploration the earlier portion of the navigable season; but such exploration should, if possible, include an examination of the coast from Cape Johnson to Cape Crozier, with a view to finding a safe and suitable place for the operations of landing in the event of your deciding that the ship shall not winter in the ice.

The chief points of geographical interest are as follows: To explore the Ice Barrier of Sir James Ross to its eastern extremity; to discover the land which was believed by Ross to flank the barrier to the eastward, or to ascertain that it does not exist; and generally to endeavour to solve the very important physical and geographical questions connected with this remarkable ice formation.

17. Owing to our very imperfect knowledge of the conditions which prevail in the Antarctic seas, we cannot pronounce definitely whether it will be necessary for the ship to make her way out of the ice before the winter sets in, or whether she should winter in the Antarctic Regions. It is for you to decide on this important question after a careful examination of the local conditions.

18. If you should decide that the ship shall winter in the ice, the following instructions are to be observed :—

(*a*) Your efforts, as regards geographical exploration, should be directed, with the help of depôts, to three objects—namely, an advance into the western mountains, an advance to the south, and the exploration of the volcanic region.

(*b*) The Director and his staff shall be allowed all facilities for the prosecution of their researches.

(*c*) In carrying out (*a*) and (*b*) due regard is to be had to the safety and requirements of the Expedition as a whole.

(*d*) You have been provided by Sir Leopold M'Clintock and by Dr. Nansen with complete details respecting sledge work both by men and dogs, and you have yourself superintended every item of the preparations connected with food, clothing, and equipment. You will be guided by the information and knowledge thus acquired.

(*e*) Lieut. Armitage, R.N.R., who has been appointed second in command and navigator to the Expedition, has had experience in the work of taking astronomical, magnetic, and meteorological observations during three Polar winters. He has also acquired experience in sledge travelling and in the driving and management of dogs. You will, no doubt, find his knowledge and experience of great use.

(*f*) Early in 1903 your ship should be free from the ice of the winter quarters, and you will devote to further exploration by sea so much of the navigable season as will certainly leave time for the ship to return to the north of the pack ice. Having recruited at your base station, you will then proceed with your magnetic survey across the Pacific and return to this country.

19. If, on the other hand, you should decide not to winter, you will bear in mind that it is most important to maintain scientific observations on land throughout the winter, and therefore if you are able, in consultation with the Director, to find a suitable place for a landing party between Cape Johnson and Cape Crozier, and decide that such a party can be landed and left without undue risk, the following instructions will apply :—

(*a*) You will land a party under the command of such person as you may appoint. Such party shall include the Director, the physicist, and one of the surgeons, and such other persons as you may consider desirable. But no person is to be left without his consent in writing, which you will be careful to obtain and preserve.

(*b*) You will give every practicable assistance in establishing on land this party, which you will supply with all available requisites, including a dwelling hut, an observer's hut, three years' provisions, stores, fuel, sledges, and dogs.

(*c*) No landing party is to be established on any other part of the coast than that between Cape Johnson and Cape Crozier, as it is above all things essential that in case of accident the approximate position of the party should be known.

(*d*) Before it is so late as to endanger the freedom of your ship, you will proceed north of the pack and carry out magnetic observations with sounding and dredging over as many degrees of longitude (and as far south) as possible, so long as the season and your coal permit, and then return to your base station, whence you will telegraph your arrival and await further instructions.

20. You are to do your best to let us have, and to leave where you can, statements of your intentions with regard to the places where you will deposit records, and the course you will adopt, as well as particulars of your arrangements for the possible need of retreat, so that in case of accident to the ship, or detention, we shall be able to use our best endeavours to carry out your wishes in this respect.

21. In an enterprise of this nature much must be left to the discretion and judgment of the commanding officer, and we fully confide in your combined energy and prudence for the successful issue of a voyage which will command the attention of all persons interested in navigation and science throughout the civilised world. At the same time, we desire you constantly to bear in mind our anxiety for the health, comfort, and safety of all intrusted to your care.

22. While employed on this service you are to take every opportunity of acquainting us with your progress and your requirements.

23. In the unfortunate event of any fatal accident happening to yourself, or of your inability, from sickness or any other cause, to carry out these instructions, the command of the ship and of the Expedition will devolve on Lieutenant Armitage, who is hereby directed to assume command and to execute such part of these instructions as have not been already carried out at the time of his assuming command. In the event of a similar accident to Lieutenant Armitage the command is to devolve on the executive officer next in seniority on the Articles, and so on in succession.

24. All collections and all logs (except the official log), journals, charts, drawings, photographs, observations, and scientific *data* will be the joint property of the two Societies, to be disposed of as may be decided by them. Before the final return of the Expedition you are to demand from the Naval Staff all such *data*, which are to be sealed up and delivered to the two Presidents, or dealt with as they may direct. The Director of the Civilian Scientific Staff will be similarly responsible for the journals, collections, etc., of the officers under his control. You and the other members of the Expedition will not be at liberty without our consent to make any communication to the Press on matters relating to the affairs of the Expedition, nor to publish independent narratives until six months after the issue of the official narrative. All communications are to be made to us, addressed to the care of the Secretary of the National Antarctic Expedition, London.

25. The *Discovery* is not one of His Majesty's ships, but is registered under the Merchant Shipping Act, 1894, and is governed by it. Copies of this Act will be supplied to you. You will see that the officers and crew sign the ship's articles as required by the Act. The Scientific Staff will not sign articles, but are to be treated as cabin passengers. You must be careful not to take more than twelve persons as passengers.

26. The vessel has been covered by insurance, and, in the event of her sustaining any damage during the voyage, to recover the claim from the underwriters it will be necessary for you to call in the services of Lloyd's agent, or, in his absence, an independent surveyor, at the first port of call, in order that the damage may be surveyed before repairs are effected. His survey report, together with the accounts for repairs and supporting vouchers, should be sent to us by first mail, together with a certified extract from the official log reporting the casualty.

In the event of damage occurring after you have left civilised regions precise particulars should be entered in the log, and the damage should be surveyed and repaired as soon as you return to a port where Lloyd's agent or other surveyor is available.

27. The *Discovery* is the first ship that has ever been built expressly for scientific purposes in these kingdoms. It is an honour to receive the command of her; but we are impressed with the difficulty of the enterprise which has been intrusted to you and with the serious character of your responsibilities. The Expedition is an undertaking of national importance, and science cannot fail to benefit from the efforts of those engaged in it. You may rely upon our support

on all occasions, and we feel assured that all on board the *Discovery* will do their utmost to further the objects of the Expedition.

INSTRUCTIONS TO THE SCIENTIFIC DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF.

1. The Royal Society and the Royal Geographical Society have approved your appointment as Director of the Civilian Scientific Staff of their Antarctic Expedition.

2. A copy of the instructions to the Commander of the Expedition accompanies these instructions, which are supplemental to them. You will see from the instructions to the Commander what the objects of the Expedition are, and your position relatively to him.

3. You will direct the scientific work of the gentlemen who have been appointed to assist you.

4. The names of the gentlemen associated with you are as follows:—(1) Mr. Hodgson (*Biologist*); (2) Mr. Shackleton (*Physicist*). The services of the two medical officers will be at your disposal for scientific work when not engaged on the work of their own department—namely, Dr. Koettlitz (*Botanist*), and Dr. Wilson (*Zoologist*).

5. You will note that the Commander of the Expedition has been instructed to communicate freely with you on all matters connected with the scientific objects of the Expedition, and, as far as possible, to meet your views and wishes in connection with them. The Societies feel assured that you will co-operate and act in concert with him, with a view, as far as possible, to secure the success of an enterprise which it is hoped will be attended with important results in the various branches of science which it is intended to investigate.

6. All collections, logs, journals, charts, drawings, photographs, observations, and scientific *data* will be the joint property of the two Societies, to be disposed of as may be decided by them. Before the final return of the Expedition, you are to demand from the staff under your control all such *data*, which are to be sealed up and delivered to the two Presidents, or dealt with as they may direct. On the return of the Expedition you will be expected to superintend the distribution of specimens to specialists approved of by the two Councils or their representatives, and to edit the resulting reports. You will also be expected to contribute a report on the scientific results of the Expedition for the official narrative. As it may be desirable during the progress of the voyage that some new scientific discovery should be at once made known in the interests of science, you will, in such a case, inform us of it by the earliest opportunity.

7. You and the other members of the Expedition will not be at liberty, without our consent, to make any communication to the Press on matters relating in any way to the affairs of the Expedition, nor to publish independent narratives until six months after the issue of the official narrative. All communications are to be made to us, addressed to the care of the Secretary of the National Antarctic Expedition, London.

8. Should any vacancies in the Scientific Staff occur after the Expedition has sailed from England, you may, with the concurrence of the Commander, make such arrangements as you think desirable to fill the same, should no one have been appointed from England.

9. You and the members of the Scientific Staff will be cabin passengers joining the Expedition at your own risk, and neither the owners nor the captain are to be responsible for any accident or misfortune which may happen to you. You will obtain from each member a letter to this effect.

GENERAL.

Ordnance Survey of Scotland.—The following publications were issued in March 1901 :—Parish Maps on the scale of 1 : 2500, revised (3s. each). *Aberdeenshire.*—Sheets XV. 10, 14 ; XX. 8, 16 ; XXI. 5, 7, 10, 11, 12, 13, 14, 15, 16 ; XXII. 5, 7, 10, 12 ; XXIII. 2, 6, 11 ; XXVII. 16 ; XXVIII. 9, 10, 12, 13, 14, 15, 16 ; XXIX. 4, 5. *Clackmannanshire.*—Sheets CXXXIV. 7, 9. *Perthshire.*—Sheets LXII. 15 ; LXIV. 6, 9 ; LXXIII. 1, 2, 3, 5, 7, 9, 13 ; LXXXIV. 2, 3, 6, 7, 8, 13, 15, 16 ; LXXXV. 2, 5, 6 ; XCVI. 1, 7, 16 ; XCVII. 4, 5, 7, 9, 10, 11, 15 ; CVIII. 12 ; CXXXIV. 7. *Zetland.*—Sheet XV. 9. One-inch Map of Edinburgh, with roads and water printed in colour, comprising Sheet 32 and parts of Sheets 33, 40, and 41 (1s. 6d.). Six-inch Maps (Quarter Sheets—revised). *Clackmannanshire.*—139 SE. (1s.). *Perthshire.*—(43A NE. and 44 NW. ; 44 NE., 44 S.E. ; 55 NW., 55 NE., 55 SW. ; 67 NE. ; 68 SW. ; 77 NE., 77 SE. ; 80 NE. ; 90 NW., 90 NE., 90 SW. ; 91 NE. ; 92 NE., 92 SW. ; 93 NW., 93 NE., 93 SE. ; 102 NE., 102 SE. ; 103 SW., 103 SE. ; 106 NE. ; 107 NW. ; 113 NW., 113 NE., 113 SE. ; 114 SW. ; 115 NE. ; 116 NE. ; 122 NE., 122 SW. ; 124 NE. ; 125 SE. ; 132 NE., 132 SW., 132 SE. ; 138 NE. (1s. each).

The following publications were issued in April 1901 :—Parish Maps on the scale of 1 : 2500, revised (3s. each). *Aberdeenshire.*—Sheets XX. 7, 10, 11, 12, 14, 15 ; XXI. 6, 8 ; XXIII. (7 and 3), 15 ; XXVI. 7, 8, 11, 12, 14, 15, 16 ; XXVII. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 ; XXVIII. 5, 6, 7, 8, 11 ; XXIX. 2, 3 ; XXXIV. 2, 3, 4 ; XXXV. 1, 2, 3, 4. *Inverness-shire.*—Sheets CL. 2, 7 (11 and 10). *Perthshire.*—Sheets LXII. 14 ; LXXIII. 10, 11, 14, 15 ; LXXXV. 3, 7, 9, 10, 11, 12, 13, 15, 16 ; LXXXVII. 14 ; XCVII. 1, 6, 13, 14 ; CVIII. 4, 8, 16 ; CIX. 8, 9, 12 ; CX. 9 ; CXVIII. 2. *Zetland.*—Sheets II. 11, 12, 15, 16 ; III. 5, 9 ; IV. 16 ; V. 3, 4, 7, 8, 11, 13, 15, 16 ; VII. 3, 8 ; VIII. 1 ; XV. 5 ; XVII. 8. Six-inch Maps (Quarter Sheets, revised). *Clackmannanshire.*—139 NW. (1s.). *Perthshire.*—(2 SE. and 5 NE.) ; 18 NW. ; 77 SW. ; 89 SW. ; 102 SW. ; 115 SE. ; 126 SW. (1s. each). With Contours :—*Aberdeenshire.*—73 SE. (1s.). *Clackmannanshire.*—127 SW. ; 139 NE. ; 140 NE. (1s. each). *Perthshire.*—125 NE. ; 127 SW. (1s. each). Reprints, without revision :—*Ross-shire* and *Cromartyshire.*—LV. 4, and XCIX. 4 (both with areas added).

The following publications were issued in May 1901 :—Parish Maps on the scale of 1 : 2500, revised (3s. each). *Perthshire.*—Sheets LXXV. 6 ; LXXXV. 1, 14 ; LXXXVII. 5, 13, 15 ; XCVII. 2, 8, 16 ; XCVIII. 3, 7, 15 ; XCIX. 5, 9, 10, 13 ; CIX. 1, 2, 3, 4, 5, 6, 10, 11, 13, 14, 15, 16 ; CX. 1, 2, 4, 5, 6, 7, 11, 12 ; CXI. 5, 6, 9, 10, 13, 14 ; CXIX. 1, 2, 3, 5, 6, 9, 13 ; CXXVIII. 1. *Aberdeenshire.*—Sheets XV. 6 ; XX. 6 ; XXVI. 6 ; XXVIII. 3, 4. *Zetland.*—Sheets VII. 4 ; VIII. 2, 3, 5, 6, 7, 8, 9, 10, 11, 12 ; XI. 15 ; XV. 1, 8, 12 ; XVI. 3 ; XVII. 3, 4 ; XVIII. 1, 5 ; XX. 8, 12, 16 ; XXI. 1, 4, 8, 9, 13 ; XXII. 9, 10, 13, 14, 15 ; XXIV. 1, 2, 5, 6, 16 ; XXV. 8, 12, 16 ; XXIX. 4, 12, 16 ; XXX. 13 ; XXXII. 14 ; XXXV. 13 ; XXXVII. 7, 10 ; XXXVIII. 6, 8, 12, 13 ; XXXIX. 5, 6, 9 ; XLI. 5 ; XLII. 8. One-inch Maps, revised (mounted in sections and folded for the pocket, 2s. 6d. each) : Sheets 29, 30, 31, 37, 38, 39, 45, 46, 47 —the district between Glasgow and Oban. Six-inch Maps, Quarter Sheets, revised : *Perthshire.*—1 SE. ; 5 NW. ; 7 SW. ; 14 NE. ; 101 NW. ; 115 SW. (1s. each). With Contours :—*Aberdeenshire.*—37 NW. ; 46 NE. ; 73 NW. ; 82 NE. ; 83 NW., 83 SW. ; 94 NW., 94 SW. *Clackmannanshire.*—126 NE. ; 133 NE. ; 133 SE. *Perthshire.*—52 SE. ; 87 NE. ; 94 SE. ; 95 NW. ; 126 SE. (1s. each). Reprints, unrevised, of the following have been prepared :—Parish Maps on the scale of 1 : 2500 :—*Caithness-shire.*—XII. 5 ; *Elginshire.*—XIII. 9.

NEW BOOKS.

Ancient India as described in Classical Literature. Being a collection of Greek and Latin texts relating to India, extracted from Herodotus, Strabo, Diodorus Siculus, Pliny, Aelian, Philostratus, Dion Chrysostom, Porphyry, Stobæus, the Itinerary of Alexander the Great, the Periégésis of Dionysius, the Dionysiaka of Nonnus, the Romance History of Alexander, and other works. Translated and copiously annotated by J. W. M'Crindle, M.A., LL.D. With Introduction and copious Index. Westminster: Archibald Constable and Co., Ltd., 1901. Pp. xxi + 226. *Price 7s. 6d. net.*

Some twenty-seven years ago our honorary Fellow, Dr. M'Crindle, when Principal of Patna College, began to publish in the *Indian Antiquary*, then edited by Dr. Burgess, C.I.E., annotated translations of the Greek and Latin texts which describe Ancient India and its people. His first treatment of the fragments of the *Indika* of Megasthenes, ambassador of Seleucus to the great Sandrocottus at old Patna, was so valued as supplying a want that he began a complete series of such translations and introductions in six volumes. This work fitly completes the undertaking, to which we may add his translation of Kosmas Indicopleustes for the Hakluyt Society. All are marked by adequate scholarship and cautious comment, the result partly of his residence in India and partly of wide reading. A brief notice of the life of each of the Greek and Latin writers is prefixed to the translations. The six volumes and the Kosmas translation are indispensable to every student of Early India, and we thank Dr. M'Crindle for producing them.

India in the Nineteenth Century. By Demetrius C. Boulger. London: Horace Marshall and Son, 1901. Pp. 360. *Price 6s. net.*

As a journalist Mr. Demetrius Boulger has for several years done good service in popularising the contemporary annals and politics of British and Central Asia. In this work, illustrated by portraits of Queen Victoria, Lord Minto, the Marquess of Dalhousie, Lord Dufferin, and some of our Feudatories, he has given us what may best be described as a series of leading articles on the history of Victorian India. He is apt to repeat himself, drawing freely on his former work, *The Story of India*. But one who is ignorant of the romance of the British conquest and administration of India will find here a readable introduction to the subject. The writer's impartiality is seen in almost every page. Save on the one subject of the Russian advance from the North, a justifiable optimism marks the narrative, and the Retrospect and Forecast with which it concludes. He is less than just to Sir Henry Lawrence when he ascribes to him "vanity," instead of misplaced sympathy with the Sikh nobles, as the motive of his policy in the Panjab. He is more than just to Lord Canning and especially Lord Lytton. He anticipates that a century hence the British public may place a scion of our reigning house in the position of resident Emperor of India.

Palestine in Geography and in History. By Arthur William Cooke, M.A. With Topographical Index and Maps. 2 vols. London: Charles H. Kelly, 1901.

These two little and clearly printed volumes, which may be studied separately, form part of the series of "Books for Bible Students," edited by Arthur E. Gregory. The Handbook is practically a compilation, especially from Professor G. A. Smith's *Historical Geography of the Holy Land*. That member of our Society has been spending April, May, and part of June in a third visit to the

East, that he may complete his great work by another volume, chiefly on the topography of Jerusalem, on Phœnicia, Damascus, and Hauran. When that book, with its maps and plans, appears we shall have a completely satisfactory work on the whole of the Holy Land and its neighbours. Till then such a handbook as Mr. Cooke's will be found useful by Bible readers and students. After a description of Palestine as a whole and of its earlier and later inhabitants and invasions, Mr. Cooke follows his authorities in a detailed survey of each province or district and its historical sites. He justly disclaims "any attempt at originality of treatment or of arrangement." Hence the writing is neither so clear nor so picturesque as personal familiarity with Syria and the East might have made it. But the little volumes, and the maps by George Philip and Son which illustrate the descriptions, will help those who do not possess Dr. G. A. Smith's *Historical Geography* or Stanley's *Sinai and Palestine*, which has now been superseded, though it will always be delightful to read. The topographical index of thirty pages contains all important Palestinian sites, with references to the Old and New Testaments and the Apocrypha, compiled by Mr. George Armstrong for the Palestine Exploration Fund.

Fazendas et Estancias. Notes de voyage sur le Brésil et l'Argentine. Par Étienne de Rancourt. With sixteen photogravures and a map. Paris: Plon-Nourrit et Cie., 1901. Pp. 286.

The object of the author seems to have been to visit various friends and compatriots who have settled in South America, and to incite the younger generation of Frenchmen to try their luck as agricultural colonists, or in commercial enterprise in that part of the world. A good deal of useful statistical and other information bearing on the subject is therefore given, and also the amount of capital necessary to start business of various kinds. He makes the same complaints of French manufacturers that are frequently laid to the charge of British merchants in British consular reports. They will not give the long credit—from six to twelve months—that German manufacturers are accustomed to accord, and they will not change their patterns to suit the taste of their customers as the enterprising and pushing Teuton is only too ready to do. Consequently the bulk of trade in South America is in German hands, and the German element predominates in the southern states of Brazil, in Parana, St. Catharine, and Rio Grande.

The peregrinations of M. de Rancourt inland did not take him any very great distance from the coast or from the railway. He landed at Rio de Janeiro, and worked down the coast in the miserable coasting steamers of the country as far as Buenos Ayres. But from Santos he went up country as far as the railway permitted. He did not think much of Rio de Janeiro; he was more impressed by San Paulo, and most of all by Buenos Ayres. Here he was greatly struck by the bustle and energy, and at the high pressure at which business people live, while the hotels defy the best in Paris, especially in the matter of high charges.

These notes of travel, though full of instruction and shrewd observations, are far from heavy reading. They are interspersed with many lighter passages, written in a bright and humorous vein, which makes their perusal a matter of pleasure.

The North-Americans of Yesterday. A comparative study of North-American Indian Life, Customs, and Products, on the Theory of the Ethnic Unity of the Race. By Frederick S. Dellenbaugh. New York and London: G. P. Putnam's Sons, 1901. With over 350 Illustrations. Pp. 487.

This volume must not be judged by that part of the preface in which the author describes "Paleolithic" and "Neolithic" as two of the most confusing,

misleading, and useless terms ever invented. None of these depreciatory adjectives is in the least deserved. A paleolithic instrument is one that has been found in undisturbed lower strata of the quaternary period, while a neolithic implement belongs to the uppermost stratum. It is therefore, in the first instance, a purely geological question, and, primarily, does not depend on the form of the implement at all. Apart from this, the author gives a highly readable and interesting summary of all that is known of the Amerinds—a new generic term that covers all the native races on the continent of America.

He supports the late Dr. Brinton's view that, though composed originally of different elements, the Amerinds, at a remote period, were welded into an ethnic unity, and must be regarded as such. According to the author's theory, before the last glacial epoch the American continent possessed a temperate climate, and was inhabited far in the direction of the polar regions. With the approaching cold and the glaciation of the northern and southern parts of the continent over immense areas, the inhabitants were driven towards the centre. The consequence was an excessive pressure of population and consequent crowding in the neighbourhood of Panama and that part of the continent where it is most cramped and confined. The greater civilisation of the Mayas of Yucatan, of the Aztecs, and Peruvians, is mainly to be ascribed to this density of population, for a high degree of civilisation is never found to arise in a scantily populated district. It was during this period of comparative proximity of all the races on the continent that there arose that ethnic unity which distinguishes the Amerind from every other inhabitant of the earth.

In a series of chapters profusely illustrated with photogravures and woodcuts, the author introduces us successively to the languages, picture-writing, sign-language, basketry, pottery, weaving, sculpture, architecture, weapons, music, agriculture, customs, myths, government, etc., etc. of the Amerind races. They never possessed domestic animals, wheeled vehicles, fireplaces, chimneys, or stringed instruments of music. The noble art of boxing was also unknown, though wrestling was in vogue. The only Amerinds that ever thought of inventing a lamp were the Eskimo. A practice common to Amerinds and Europeans was that of incising on stone, cup-marks, surrounded by one or more circular or horseshoe-shaped grooves. Archæologists for long have puzzled their brains to account for these marks, but no explanation as yet given is considered satisfactory. The author propounds a new theory. He supposes the cup-marks were made for the purpose of rounding the end of a fire-stick. This, of course, leaves unexplained the concentric circles and the ducts that often lead into them.

The author justly maintains that the so-called "mound-builders" of the Mississippi valley were certainly Amerinds, and the mounds were erected by different tribes for different purposes. He also warns us against the conclusions of Squier and Davis, whose volume was published over fifty years ago, and is nowadays out of date. Music, in the ordinary sense of the word, can hardly be said to exist. The songs of the Navajos form "a connecting link between excited howling and excited singing. The quality of the tone is indescribable, being more like a yelp than anything else." Yet these songs are not without their use. If sung at night they drive away any evil spirit that may be lurking near the spot.

Like true-born Britons the Amerinds are very fond of games or any form of sport on which a wager can be laid. That is a *sine quâ non*; a game without a stake is no game at all. Whip-top is universally played by boys, and a favourite game of the Eskimo is football—of a primitive kind.

A Year in China, 1899-1900. By Clive Bingham, C.M.G. (late Hon. Attaché to H.M. Legation in Peking). London: Macmillan and Co., 1901. Pp. 225. *Price* 8*s.* 6*d. net.*

A plain, unaffected, and most interesting narrative, without any pretence to special knowledge or extraordinary adventures, this well-timed book will commend itself to all for its modesty, honesty, and worth. Moreover, it possesses the charm of a simple and graphic style, in which the writer recounts admirably, yet concisely, what he did and what he saw, without exaggerating the one or enlarging upon the other. A diplomat, he keeps his opinions upon many questions to himself, restricting himself to his experiences and to *choses vues*. His wanderings were certainly as enterprising as they were extensive, yet, partly owing to his official position, partly to his own tact and pluck, he overcame all difficulties, and generally experienced both courtesy and assistance from the Chinese and Russian officials whose cities he entered. A brief statement of Mr. Bingham's route will show how widely he travelled during his well-spent "Year in China." From Canton he proceeded to Hankow and thence to Pekin, then passing through Manchuria he reached Eastern Siberia, and from thence he passed through Korea and Japan. Returning to China, he sailed up the Yangtze Kiang to Chung King, and proceeded to Chentu and Huan. It was now late in March 1900, and he had to get back to Pekin as quickly as he could, so, although it had been rarely travelled by Europeans and the country was disturbed, he pluckily adopted the shortest and most direct route from Chentu to the capital *viâ* Sianfu, Tungkuan, Huaiking, Weihui, and Tientsin. From Tientsin he had to go over to Port Arthur, a town which he describes as "dirty, poor, and straggling. There is no trade, the Russians are not particularly popular, and native immigration is not encouraged." The author afterwards took part in Admiral Seymour's Expedition for the relief of the Pekin Legations in June 1900, and gives a graphic description of the hardships it endured. He returned to England by the Trans-Siberian Railway, of which he furnishes a useful account, after having travelled in the Chinese Empire close upon 10,000 miles. The volume is illustrated by several excellent maps.

Kasana, Kamari. Eine Celebesfahrt. Von Fritz und Else Rinne. Hannover: Hahn, 1900. Pp. 194.

In the autumn of 1898 Professor Rinne undertook a geological expedition to the Sunda Islands, and was accompanied by his wife. This interesting and well-illustrated volume describes their journey, *viâ* Batavia and Surabaja, to the Celebes, where they stayed for six months, returning home by Java, Singapore, and Colombo. The scientific results of the expedition are naturally not to be sought for in this "Wanderbuch," but, like all books of travel by scientific men, this one possesses a fulness of knowledge and accuracy of description which the intelligent reader will duly appreciate. It is likewise written in a joyous tone which makes it pleasant reading.

Animals of Africa. By H. A. Bryden. London: Sands and Co., 1900. *Price* 6*s.* Pp. xii + 240.

This, the second volume of "The Library for Young Naturalists," deals with the animals of Africa, and is in no way inferior to its predecessor. It just hits off the happy mean that youngsters delight in, when they are at the golden age of being much too young for an advanced book and much too old for a childish book. Mr. Bryden addresses himself to boys (not children) of all ages, and when need be he uses the similes and even the language of a boy with excellent effect. This book is sure to be popular, and deserves to be so.

The Social Life of the Hebrews. By the Rev. Edward Day. ("The Semitic Series" II.) London: John C. Nimmo, 1901. Pp. viii + 255. *Price* 6*s.*

A carefully written account—from the standpoint of literary and historical criticism of the Biblical records—of the character and development of social life among the Hebrews in Palestine during the time of the Judges and Kings.

La Politique de la France en Afrique, 1896-1898. Par André Lebon. Paris: Plon-Nourrit et Cie., 1901. Pp. xi + 322.

This volume is a republication of some articles contributed to *La Revue des Deux Mondes* by the well-known Anglophobe André Lebon. One shows how Major Marchand's famous expedition to Fashoda was a deliberate manœuvre of the French government, and was very nearly successful. The last, and most important, is practically an eulogium of the administration of General Gallieni in Madagascar.

Du Transvaal à l'Alaska. Par Vincent Ruggieri. Paris: Plon-Nourrit et Cie., 1901. Pp. vii + 291.

In 1898 Signor Ruggieri left lucrative employment in Johannesburg, where he was a mining engineer, and went off to Klondyke, where he remained one season, lost his health, and found no gold, except in small quantities. He has accordingly no hesitation in pronouncing the statements of experts like Ogilvie and Dawson to be deliberate lies. He also found the Canadian government to be cheats and robbers; and so for philanthropic purposes he publishes this book, which is distinctly amusing, but we doubt if it will stem the stream of miners to the latest Eldorado.

David Livingstone. By T. Banks Maclachlan. ("Famous Scots' Series.") Edinburgh and London: Oliphant, Anderson, and Ferrier, 1901. *Price* 1*s.* 6*d.*

This is an excellent little monograph on the greatest of missionary explorers for those who do not care to tackle the classic works on the subject, viz., Livingstone's own works and his *Personal Life* by Dr. Blaikie. It would be much improved if it had one or two sketch maps showing the routes by which the famous missionary traversed South Africa.

Mentone as a Health and Pleasure Resort. By D. W. Samways, M.A., M.D. London: Bemrose and Sons, 1901. Pp. 103. *Price* 3*s.* 6*d.*

A reliable authority expressed the opinion that, to be really sure of sun and warmth in winter, Europeans must go to Africa, in other words, to Egypt, Algeria, or Tangier. Among resorts in the French Riviera, however, Mentone has always held a high place, and this small but attractive book will be found most useful by all visiting Mentone either for health or pleasure. It is by a well-known medical practitioner there, and the only thing about it we miss is a map showing the environs of Mentone, which would indicate the excursions from it much more practically than letterpress. Remarkably pretty illustrations adorn the volume.

The Silver Map of the World, commemorative of Drake's great voyage 1577-1580. By Miller Christy. London: Stevens, Son, and Stiles, 1900. Pp. xii + 71 With 10 plates. *Price* 12*s.* 6*d. net.*

This little book professes to be a monograph on a silver medallion, 2¾ inches diameter, on which is engraved a map of the world in two hemispheres, showing the track of Drake's circumnavigation of the globe, but it is really far more. The

medallions are interesting in themselves: three copies only are known to exist, and of these two are in the British Museum. Mr. Christy believes the map, which is beautifully and correctly engraved, to have been executed in 1581 by the French engraver who, under the initials F. G., engraved the map of the New World for Hakluyt's edition of Peter Martyr's *De Orbe Novo*, issued in Paris in 1587.

The interest of the book, however, lies not so much in the medallion or its engraving, as in the light it throws on an extraordinary geographical misconception, begun in the middle of the sixteenth century, and continued for more than two hundred and fifty years. This misconception arose with the Zeno frauds, a subject which Mr. Miller Christy touched on in *Danish Arctic Expeditions* (Hakluyt Society, 1897, vol. i. App. 2), and which has been subsequently fully exploited by Mr. F. W. Lucas in an exhaustive monograph published in 1898 (London: Stevens, Son, and Stiles). For a full account of this interesting subject the reader is referred to the volume itself, or to either of the books noted; but very briefly the incidents may be thus sketched. In 1558 a book was published in Venice purporting to be an account of the voyages in the North Atlantic of two brothers, Nicolas and Anthony Zeno, about the end of the fourteenth century, and founding thereon a Venetian claim to the discovery of America. The volume contained a chart which was accepted as genuine at the time. Among other incorrect features, that chart showed in the middle of the Atlantic a large and wholly imaginary island which it named Frislandia. In 1576, 1577, 1578, while Drake was circumnavigating the globe, Frobisher made three voyages to North America. With him he took a copy of Zeno's chart. When on his voyages he encountered land about lat. 60°, which we now know to be Greenland, but which Frobisher fully believed to be the island Frislandia, since Greenland was erroneously shown on the Zeno chart much further to the north. Leaving this spot, he sailed farther to the west, and there discovered the bay still known as "Frobisher's," and which Frobisher marked correctly as part of North America. Davis, who explored the same districts in 1585, 1586, 1587, landed, like Frobisher, in Greenland, but did not recognise the spot as Frobisher's landing-place, though on his third journey he seems to have discovered that Zeno's map was a fraud, and concluded that Frobisher had mistaken Greenland for the mainland of America, and that Frobisher's "Strait" or Bay was really in Greenland, and not where correctly located by Frobisher. Geographers seem to have agreed in this, for on all maps published subsequent to 1592 an entirely imaginary inlet intersects the peninsula of Greenland, sometimes completely severing the southern portion from the mainland. This strait growing gradually less continued on maps until nearly the middle of the nineteenth century. In the Silver Map, though the imaginary Frislandia is shown, Frobisher's Bay is correctly located, showing that the medallion was engraved before Davis's strange misconception arose.

About the Zeno frauds Mr. Christy has an interesting theory which carries conviction, viz., that there was some foundation of truth in the author's (or editor's) book and chart. He believes that his ancestors may have travelled in north-western Arctic regions, and he may have found some of their notes which, like a modern traveller (?) of whom we have lately heard, he cooked into an imaginary book of travel; and he also believes that Zeno did find and piece together a "rotten old map" of some early explorers in a way that deceived the sixteenth-century explorers. In this he traverses the views of Mr. Lucas, who looks upon the whole as a concocted fraud; at the same time Mr. Christy pays a just tribute to Mr. Lucas's monumental work.

Not the least valuable part of the monograph is a series of reproductions of contemporary charts of the North Atlantic, and two ingenious maps designed by

the author, in which Zeno's chart is superimposed on the real map, and in one of which Frobisher's supposed and real routes are shown.

The book is very well printed on hand-made paper, and is tastefully bound.

Gazetteer of Upper Burma and the Shan States. In five vols. Compiled from official papers by J. George Scott, C.I.E., F.R.G.S., assisted by J. P. Hardiman, I.C.S. Vols. I. and II. Burmah: Rangoon Government Printing, 1900.

The first two volumes of this important work issued last year deal with the Physical Geography, History, Religion, Ethnology, Arts, Agriculture, and Administration of Upper Burma and the Shan States. The history of Burma previous to the British annexation of Upper Burmah in 1885, and the termination of the inglorious reign of Thibaw Min, is not a record of many achievements of interest to the outside world. Mindón Min, the father of Thibaw, who reigned twenty-six years, and founded Mandalay in 1857, was perhaps the best representative of the eleven sovereigns of the Alaungpaya dynasty founded in 1752 by a farmer who developed into a dacoit, and died a king. Upper Burma is as yet largely undeveloped and sparsely populated. In 1891 the population was a little over 3,000,000, or about 36 per square mile. The natural resources are numerous, and include—besides timber—coal, iron, gold, and other useful and valuable minerals, the production of which will give employment to a far larger population at some future date, and will open up a field for profitable immigration from more densely peopled quarters of the empire. These volumes supply much valuable material for students and specialists in Burmese ethnography, and, with the three remaining volumes, will provide an extremely valuable compendium of our present knowledge of Upper Burma and its possibilities.

Schweden. Reisehandbuch . . . herausgegeben vom Schwedischen Touristenverein (Svenska Turistföreningen) zu Stockholm. Mit 36 Karten und Plänen, Zweite, durchaus neu bearbeitete Auflage. Stockholm: Wahlström und Widstrand, 1900. Pp. viii + 416.

In this new and enlarged edition of the Swedish Tourist Club's Guidebook to Sweden the plan of the work remains the same, but in the three years that have elapsed since the first edition a good deal of fresh material has been collected. The whole has been thoroughly revised, and the editing has been in the capable hands of Dr. Gunnar Andersson The result is practically a new work. In the Introduction (pp. 1-19) there is a fund of practical information. Then follow chapters on the Physical Geography (pp. 21-32) by Dr. Gunnar Andersson; the History of Sweden (pp. 33-58) by Dr. Karl Hildebrand; on Literature and Art (pp. 59-72) by Dr. John Kruse; an Introduction to Swedish Language (pp. 73-104) by C. O. Nordgren, comprising grammar, vocabularies, and conversations. The best routes to Sweden are then enumerated (pp. 105-108). The remainder of the book is occupied with thirteen itineraries, with precise details, practical and historical, through all parts of Sweden, and a good index. The book is well illustrated with maps and plans. As a handbook to Sweden both for the visitor and the student, the work merits our highest commendation. We do not know if the English edition, which was published by Messrs. George Philip & Son, has been revised. We would suggest that whether in German or in English, the spelling of the topographic names should be Swedish and official, both in the text and on the maps.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

MOUNTAINS.

By Professor James Geikie, F.R.S.

I.

Of mountains large and small there would appear to be an almost infinite variety—some rising in lonely majesty above far-stretching plains and plateaux; others clustered together irregularly; not a few, on the other hand, extending in definite directions as chains and ranges. To one or other of these groups every height must belong. The classification, therefore, would seem to be natural, but it is only apparently so. Little consideration serves to show indeed that it is quite artificial, for it groups in one and the same division mountains of the most diverse character and origin. Amongst isolated mountains, for example, are included many volcanic heights and a great host of prominent elevations which have nothing volcanic about them. In like manner while some irregularly grouped mountains are of volcanic origin, others are certainly not so, but have originated in various ways. So again, mountain chains and ranges are often strikingly contrasted both as regards structure and origin.

No classification can be considered satisfactory which does not take into consideration the structure and geological history of mountains. From this point of view it is not hard to arrange every variety of mountain in a natural manner. There are in fact only two great classes of mountains. One of these comprises every height which owes its origin either (*a*) to the heaping-up of materials at the surface of the earth, or (*b*) to subterranean action which has resulted in the deformation of the earth's crust. These two groups form the great class of Original or Tectonic Mountains. The second great class includes a vast variety of heights of quite a different origin. They have not been built up by accumulation,

nor upheaved by crustal movements, but are simply the surviving remnants of ancient high lands. They now form mountains because the land masses by which they were at one time encompassed have gradually been worn down and removed. Lofty plateaux, for example, have been so deeply excavated by superficial action, that they have frequently lost their plateau character and acquired quite a mountainous aspect. Mountains of this kind we term Subsequent or Relict.

Put in tabular form, then, our classification is as follows :—

I. Original or Tectonic Mountains.

- (*a*) Accumulation mountains—including volcanoes as well as sand-hills, moraines, and all other prominent heaps of materials accumulated by whatever cause or causes at the surface.
- (*b*) Deformation mountains—including all mountains which owe their origin to the folding or the dislocation of the crust, or to the bulging up of the ground by the intrusion of matter at less or greater depths from the surface. Amongst deformation mountains, therefore, we recognise at least three distinct types, viz. :—
  1. Folded mountains—due essentially to the folding and crumpling of the crust.
  2. Dislocation mountains—due essentially to the fracturing and dislocation of the crust.
  3. Laccolith mountains—due to the bulging-up of the crust over included masses of igneous origin.

II. Subsequent or Relict Mountains.

In the present article we shall confine attention to our Original or Tectonic Mountains. We need not dwell on the phenomena characteristic of accumulation mountains. Every one is more or less familiar with the structure and origin of volcanoes. Volcanoes may occur singly or in irregular groups, or they may be distributed along definite lines or zones. They vary in size from mere monticles up to vast cones. Sometimes they appear in low-lying regions, at other times they occur upon the flanks or are strung along the crests of lofty mountain ranges. Built up as they are of materials ejected from below—of molten rock alone, or of loose stones, dust, and ashes alone, or, as is most frequently the case, partly of one and partly of the other—they all have essentially the same structure. They consist of successive layers of variable thickness, sloping outwards in all directions from the centre or centres of eruption. The actual form of a growing cone depends very largely upon the nature of the materials of which it is composed. Thus a volcano which emits highly fluid lavas does not as a rule throw out loose materials in much abundance. Hence such volcanoes have usually the form of more or less depressed cones—the liquid lavas flowing away and spreading out rapidly, while the limited supply of loose ejecta does not favour rapid growth in the vicinity of the crater. Viscous lavas, on the other hand, do not flow so rapidly, and tend therefore to coagulate at no great distance from the focus of eruption. And as they are generally accompanied by abundant discharges of loose ejecta, the

resulting cone is usually more or less abrupt. Hence, in the case of active volcanoes, the external form is an expression of the internal or geological structure.

Volcanoes are subject, like all other portions of the land-surface, to the modifying influence of the superficial or epigene agents of change. While in a state of activity they are worn and degraded by rain and torrents, by which they are often deeply scarred and furrowed. But such ravages are more than compensated for during times of eruption and accumulation. When volcanic action ceases, however, there can be no such compensation—degradation then proceeds apace. The more or less steep inclination of the surface and the weak geological structure favour the action of the epigene agents. Gullies and ravines are rapidly deepened and widened; rock-falls and landslips ever and anon take place; till sooner or later the symmetry of the original cone disappears. Undermined and breached in every direction, the mountain eventually loses the distinctive aspects of a growing volcano. After a prolonged period all that may be left projecting above the general level of the land may be the cone or plug of igneous rock which cooled and consolidated in the funnel or pipe of eruption. Of such highly denuded volcanoes many occur in Scotland. They form, sometimes, conical hills, often with smooth, grassy slopes; in other cases they rise suddenly and abruptly as steep, rocky monticles. The Binn Hill at Burntisland, Largo Law, North Berwick Law, Arthur Seat, and probably also the Castle Rock and the Bass, are examples. Volcanoes, then, may be looked upon as typical "accumulation mountains," in which while they are still growing internal structure and external form coincide. No sooner are they extinct, however, than they begin to lose their characteristic shape, and a time at last arrives when there ceases to be any correspondence between structure and configuration.

But volcanoes are not the only examples of "accumulation mountains." Materials are heaped up at the earth's surface by other than subterranean action. Thus *dunes* owe their origin to the action of wind, while *moraines* are built up by glaciers. True, neither dunes nor moraines attain the dimensions usually indicated by the term *mountain*. The term, however, is rather popular than scientific, and in a scientific classification must be taken to include not only the loftiest elevations, but inconsiderable hills and monticles as well. For our classification is based essentially on geological structure and origin, and takes no note of the relative dimensions of hills and mountains. Amongst "accumulation mountains," therefore, we must arrange dunes, moraines, and all other hills which are due to the heaping-up of materials at the surface by natural causes. Many of these epigenetic hills are doubtless of insignificant size. Dunes and moraines, for example, do not very often exceed 100 feet, but now and again the former attain heights of 400 to 600 feet, while the latter not infrequently reach greater heights, sometimes forming hills over 1000 feet high.

Coming now to the next group of Tectonic mountains, we may briefly describe the several types of mountains which owe their origin to deformation of the earth's crust. By far the most conspicuous type

is that known as "Folded mountains," comprising as it does the greatest chains and ranges of the Old and New Worlds. The Alps, the Pyrenees, the Carpathians, the Himalaya are all folded mountains, and the same may be said of the great mountain-chains which extend almost continuously along the western borders of North and South America, and the corresponding chains and ranges of Eastern Asia and its archipelagoes.

All these mountains, however much they may differ in configuration,

Fig. 1.—Section across the Uinta Mountains—a broad anticline broken by a dislocation or fault, *f*.

are characterised by a well-marked geological structure. They are composed essentially of highly flexed and folded strata. No doubt they show other structures—besides being folded, the rocks are often traversed by dislocations large and small, and by eruptive masses of different kinds. But it is the folded character of the strata which is the most essential and typical structure. Sometimes the folding is of a simple enough

Fig. 2. Symmetrical Flexures of the Jura Mountains. *a*, *a*, Anticlines; *s*, *s*, Synclines.

type. Occasionally, for example, the rocks entering into the formation of a mountain-range are arched up in one single broad "saddleback" or "anticline," as it is termed. (See fig. 1.) Or in place of one fold we may have a series of many symmetrical folds—the rocks rising and falling, as it were, in a succession of uniform undulations. (See fig. 2.) But usually the structure is much more complex—the folds being no

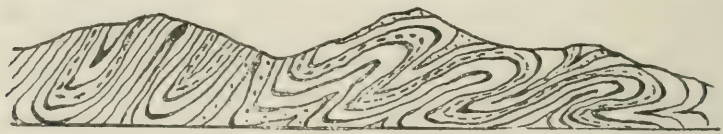

Fig. 3.—Unsymmetrical Flexures.

longer open and symmetrical, but closely compressed and inclined at all angles, or even, in many places, quite overturned and lying on their sides. (See fig. 3.) This complex flexing and folding is usually, as already indicated, accompanied by great dislocations and displacements of the strata, and not infrequently by the appearance of veins, dykes,

and irregular masses of formerly molten matter, which may traverse the disturbed strata in all directions.

It is often very hard to unravel the geological structure of such a region. Not only are the overturnings and displacements of the strata extremely puzzling to follow, but the difficulties of the geologist are increased by certain peculiar rock-changes which usually accompany such structures. One cannot doubt that the folding and displacements are the result of subterranean action. The sedimentary strata which enter so largely into the formation of folded mountains were originally deposited as approximately horizontal beds—they could not possibly have been accumulated and built up in the positions they now occupy. In a word, the geological structure is clear evidence of crustal compression. Strata attaining a thickness of many thousands of feet have been squeezed together, folded, contorted, fractured, and displaced by some irresistible force. We are not surprised, therefore, to find that the rocks so disturbed have themselves undergone certain changes, and acquired textures and structures which they did not originally possess. Rock-changes of the kind referred to are most pronounced in those parts of a mountain-range where the strata are most thoroughly contorted, crumpled, and jumbled. They become less and less conspicuous as we recede from the region of greatest disturbance.

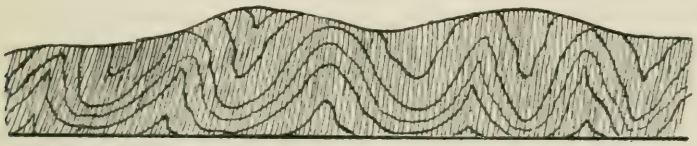

FIG. 4.—Slatey cleavage. The undulating lines represent folded strata; the steeply inclined lines represent cleavage.

Of superinduced structures, one of the first to arrest attention when we are approaching a region of highly-disturbed rocks is known as *slatey cleavage*. In this structure the strata are traversed by numerous closely-set parallel division-planes, the direction of which coincides with the axial planes of the folds, and thus they cut the planes of bedding at all angles. (See fig. 4.) Cleavage can be produced experimentally in such substances as bees-wax. When a lump of that substance is strongly compressed it acquires quite a fissile character—the planes of the superinduced laminæ being disposed at right angles to the direction of the pressure. That slatey cleavage is similarly the result of pressure is at once suggested by the fact of the coincidence of the planes of cleavage with the axial planes of the rock-folds. Examining a thin slice of roofing-slate, under the microscope, the minute grains of which the rock is composed are observed to be flattened and drawn out in the direction of the cleavage-planes. Even the unaided eye may often detect similar evidence of compression in the folded strata of a mountain-range—fossils, when these are present, being often flattened and distorted, while the rounded, water-worn stones of conglomerates are not infrequently crushed and elongated in the direction of the axial planes of the great rock-folds.

The crustal compression, which is believed to have been the cause of rock-folding and slatey cleavage, has induced still further changes. Cleavage is best developed in places where the mountain rock-folds are tolerably regular. But when the flexuring and folding become more complex, true cleavage-planes gradually disappear and are replaced by the structure termed *foliation*. Indications of this approaching change are shown first by the development of plates of mica on the cleavage-planes, which thus acquire a silvery glaze or lustre. As the complexity of the geological structure increases, the slatey rocks gradually become more and more crystalline in texture, until at last they pass into the type of rocks known as *schists*. These rocks are essentially crystalline—the minerals of which they are composed being arranged in roughly alternate laminæ or folia. In ordinary slatey cleavage the rocks have simply been compressed—their constituent grains and particles have been squeezed and flattened out, but otherwise they have not been changed. The original sedimentary character of the rock can still be discerned. But with increased crushing and compression the rocks were not merely cleaved, but actually began to flow, as all solids will do when subjected to sufficient pressure. During such plastic movements, many complex chemical and mineralogical changes were induced, whereby the original character of the rocks became greatly modified, and were often more or less completely changed. Sedimentary rocks have in this way been metamorphosed into crystalline schists of many different kinds, while crystalline igneous rocks like granite have likewise become foliated, and even ancient schists have had new planes of schistosity developed in them.

In a word, then, we learn that rock-changes become more and more pronounced as the foldings and displacements increase in complexity. So long as the folds are not very closely compressed the original character of the rocks may be quite apparent, even when slatey-cleavage is well developed. But when the evidence of disturbance becomes more and more marked—when crumpling, contortion, and jumbling are most conspicuous, then crystallisation and foliation predominate—the original character of the rocks being rendered more and more obscure, and often quite obliterated.

The facts thus briefly set forth suffice to show that the essential structures of the class of mountains we are now considering are the result of intense crustal compression. The cause or causes of such movements of the crust we need not at present discuss. It will be sufficient to state that geologists generally attribute folding and its accompaniments to the cooling and contraction of the globe. As the nucleus cools it contracts, while the already cooled crust becomes wrinkled in places, in order to accommodate itself to the diminishing diameter of the nucleus which it encloses. In most cases it would appear that the lateral movement of the crust which brings about rock-folding on the grand scale has been in one direction. Thus, if we have a great mountain-chain running from west to east we usually find that the lateral pressure has been directed either from south to north or from north to south—and not from both directions simultaneously. In the European Alps, for

example, the majority of the most conspicuous folds bend over towards the north, showing that the thrust came from the south, and the horizontal, or approximately horizontal, displacements which so frequently accompany intense folding tell a similar tale. Displaced rock-masses, often many hundreds of feet in thickness, have been pushed forward in the same direction as the crests of the great flexures.

Two types of folded mountains are recognised. In one of these a plastic or yielding portion of the crust has been folded and pushed forward against a rigid or relatively stable portion of the crust, so that the folds die out suddenly. In the other the folds, after attaining their maximum development, gradually diminish in importance. Fig. 5 represents diagrammatically the first or so-called "Alpine type." The folding, it will be observed, abruptly terminates along the margin of the rigid

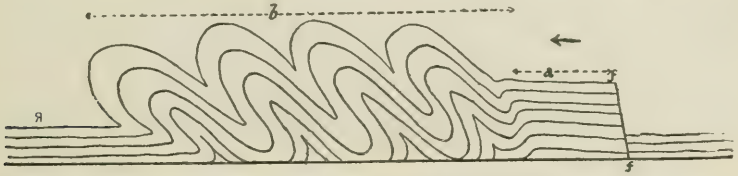

FIG. 5.—Alpine Type of Mountain Structure. *a*, Zone of least disturbance; *b*, Zone of greatest disturbance; *f*, Fault; *R*, Rigid or undisturbed area.

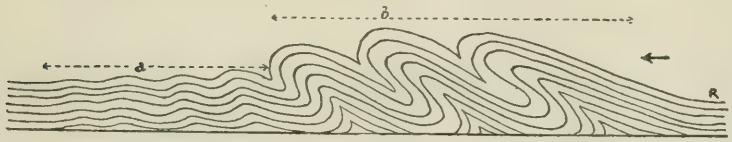

FIG. 6. Jura Type of Mountain Structure. *a*, Zone of least disturbance; *b*, Zone of greatest disturbance; *R*, Undisturbed area.

area. Frequently, however, horizontal displacements accompany the folding, and vast masses of rock are then thrust forward and piled upon the rigid area. In the other type of folded mountains ("Jura type"), the folding, after reaching its full development, gradually fades away or dies out in a series of gentle undulations. (See fig. 6.)

When the present external form or configuration of folded mountains is compared with their internal or geological structure, the two are seldom found to coincide. The longitudinal ranges and intermediate longitudinal valleys of a mountain-chain do not correspond save in a very general way with flexures or folds of the strata. Mountains do not necessarily or even often coincide with saddle-backed or arched structures—nor do valleys invariably or even frequently correspond with trough-shaped arrangements of the strata. Possibly when a mountain-chain came into existence the external form of the region may have been more or less clearly an expression of the underground structure. That is to say, the mountain ranges may have coincided with anticlines or saddle-backs, and the intervening hollows may have corresponded with geological synclines

or troughs. But so long a time has elapsed since even the youngest of our mountain-chains was upheaved, that the whole surface has been greatly modified. Everywhere we see evidence of enormous erosion and denudation. Vast masses of rock have been gradually worn down and removed—swept away as sediment from the heights, and distributed over the adjacent low grounds or upon the floor of the sea. Thus, in many places, the original configuration of a chain has been obliterated—saddle-backed mountains have been replaced by valleys and depressions, while trough-shaped strata have been carved into mountain heights.

The forms which folded mountains ultimately assume, under the action of denudation, are determined essentially by the character of the rocks and the mode of their arrangement. Certain kinds of rock and particular types of structure are more readily reduced than others. It is the more durable rocks and the stronger structures, therefore, that tend in the long-run to constitute the mountain ranges of a chain. In the younger mountain-chains of the globe the remodelling of the surface is only partially accomplished. Consequently amongst these the configuration still in many places is an expression of the underground structure. Individual ranges and intervening depressions continue to

FIG. 7.—Appalachian Ridges of Pennsylvania. *a*, *a*, Anticlines; *s*, *s*, Synclines.

coincide more or less closely with the folds and displacements of the strata. But with increasing age such coincidence becomes less and less marked, until in the oldest mountain-chains it ceases to appear. Amongst these ancient mountains, all weakly constructed heights, such as anticlinal ridges, have been reduced, while the more enduring rock arrangements, such as synclines or troughs, no longer form depressions, but have most frequently been converted into elevations by the removal of the weaker structures which formerly dominated them. The contrast is well illustrated by figures 2 and 7, the former representing the structure of a portion of the Swiss Jura—a relatively young chain, while the latter shows the Appalachian Ridges of Pennsylvania—mountains of vastly greater antiquity.

In both cases the strata, it will be observed, are arranged in symmetrical folds, but, as already stated, the structure of many mountain-chains is much more complicated—the folds being closely compressed and pushed over, so as to lie on their sides. The configuration ultimately acquired by mountains of the Alpine type naturally differs from that assumed by an elevated region of symmetrically folded strata. Generally we find that strata of variable character which have been compressed into a succession of steeply-inclined folds tend in time to assume the aspect of escarpment-mountains. The crests of the anticlinal ridges are removed, but the synclinal troughs are not developed into mountains, as in the case of symmetrically folded strata. It is the outcrops of the more durable rocks which determine the position of the heights—which,

as a glance at fig. 8 will show, are *escarpments*. The illustration, it need hardly be said, is only a diagram. In point of fact the structure of such folded mountains is infinitely more complex, the folding being usually complicated by dislocations and displacements of all dimensions, and not infrequently by abundant intrusions of igneous rock. But in ancient mountains of this type the forms worked out by erosion and denudation are in every case determined by the character of the rocks and the mode of their arrangement. And as highly-inclined folds are the rule in such mountains, the successive ranges carved out by epigene action frequently coincide with the outcrops of the more durable rocks—they are essentially escarpments—the escarpments and their dip-slopes becoming more and more pronounced as the axial planes of the folds are increasingly inclined from the vertical.

If mountains are gradually lowered by denudation, it would seem to follow that they must in time be wholly reduced. Such indeed has been the fate of not a few mountain-chains of great geological antiquity.

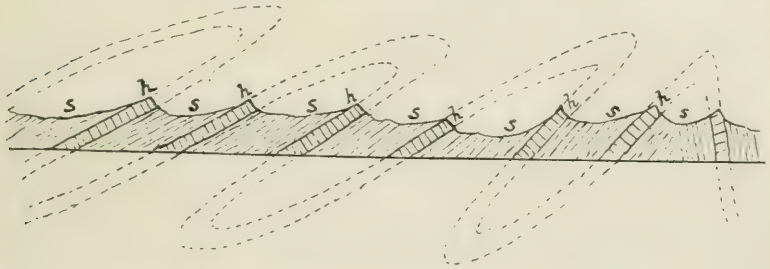

FIG. 8.—Unsymmetrical Flexures giving rise to Escarpment Mountains.
s, *s*, Relatively "soft" rocks: *h*, *h*, Relatively "hard" rocks.

Frequently we encounter plateaus and plains which, notwithstanding their superficial form have all the structural characteristics of folded mountains. Thus in former ages an extensive range of mountains stretched across what are now the low-lying plains of Belgium. The structure of that region is highly complicated, the strata being arranged in a succession of closely compressed, unsymmetrical folds, so that younger rocks are folded underneath older rocks, while here and there the crust has yielded to the lateral movement by fracturing, and vast masses of strata have been thrust forward over the surface of rocks much younger than themselves. Yet the gently undulating ground gives no hint as to the presence of these buried mountain-structures. The old mountains have been gradually removed and cast into the sea. Should the relative level of land and ocean remain unchanged for a sufficient space of time a similar fate must overtake all mountains. But a multitude of facts conspire to assure us that this level has no permanency. We know that certain mountain-chains, after experiencing enormous denudation, have been submerged or partially submerged, and become eventually buried in whole or in part under fresh accumulations of sediment, often of great thickness. Thereafter crustal movements have again supervened; the old mountain-land has bulged up under the squeeze, and a new series of

folds has been formed outside of and flanking the older series. With the re-elevation of the mountain-area a new cycle of erosion is inaugurated, and in time the whole region may again be levelled, submerged, and eventually once more uplifted. Ranges which are the result of one earth-movement alone are termed *monogenetic*; those which, like the European Alps, owe their origin to two or more such movements are known as *polygenetic* chains.

The younger folded mountains of the globe are typically represented in the Old World by the great east and west ranges of the Alps, the Himalaya, etc., and in the New World by the vast Cordilleras of South America and the Rocky Mountains of North America. These chains usually consist of a series of more or less parallel ranges, which often interosculate or merge into one another. Sometimes they extend continuously in approximately straight or gently curved lines; in other cases a chain may be more or less strongly bow-shaped. Followed in the direction of the general axis, the mountains usually become progressively higher until, towards the central portion, the greatest elevations are attained, after which the heights as a rule gradually diminish in importance. While many mountain-chains form a compact system of ranges throughout their whole extent, others divide and break up, as it were, into a series of divergent ranges. In all cases the width of a chain of folded mountains is greatly exceeded by its length.

All these features, so characteristic of our younger chains, appear likewise to have distinguished the older folded mountains of the globe, many of which are now sorely wasted and reduced in height, while others have been wholly levelled. Into the geological history of these, however, we cannot at present enter.

The next group of deformation mountains to be considered are our "dislocation mountains." They are so termed because they owe their origin not so much to folding as to fracturing and displacement of the crust. They usually occur in the form of more or less isolated heights or irregular-shaped masses of elevated ground rising abruptly above adjacent lowlands. Mountains of this type are termed "Horste" by German geologists, who cite the Harz mountains as a prominent example. They are usually composed of very old rocks, and are severed by vertical dislocations from the low tracts that surround them. If the reader will imagine a broad and lofty plateau to be cracked across in different directions by profound fractures, and the dislocated plateau to settle down irregularly, he will have some notion of the origin of Horste. Those segments of such a fractured plateau which have retained their position are Horste, and they therefore testify to a former higher crustal level.

Occasionally dislocation mountains occur as a series of parallel ranges, separated the one from the other by large vertical dislocations or "faults." The ranges of the Great Basin, which extend north and south between the Sierra Nevada and the Wasatch mountains, are of this type, and of similar origin are the Vosges and the Black Forest. The escarpments of these two mountain ranges face each other, separated the one from the other by long parallel lines of faults, between which the broad depression of the Rhine came into existence. (See fig. 9.)

Dislocation mountains, like all other elevations, become modified by

erosion and denudation, and are met with now in every stage of dissolution. Speaking generally, we may say that the best preserved examples are of relatively recent geological age. But some prominent Horste are of very great antiquity, their persistence being due to the simple fact that they consist of more durable rocks than the low-lying tracts above which they rise. In every case, however, it can be shown that such Horste have experienced excessive denudation.

There remains only another group of deformation mountains to be referred to. These are the so-called "laccoliths" ("stone-cisterns").

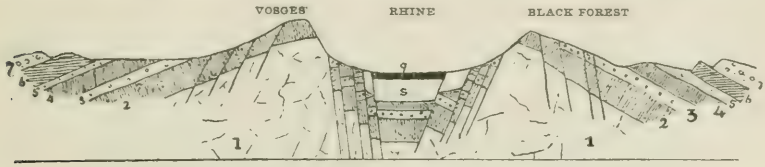

Fig. 9.—Section across the Vosges and the Black Forest (Penck). 1. Granite, etc.; 2—7, Mesozoic rocks; 8—9, Tertiary and later beds.

(See fig. 10.) A typical mountain of this kind owes its origin to the bulging-up of the crust over a concealed mass of molten matter. The latter, instead of breaking through the crust and pouring out at the surface as lava, has insinuated itself between the strata and opened for itself a chamber by lifting all the overlying beds. The best examples are those of the Henry mountains, described by Mr. Gilbert. We have no reason to doubt that laccolith mountains were formerly more or less conspicuous in our own and other lands, where intrusive igneous rocks abound. Many boss-like masses and thick lenticular sheets of basalt and other

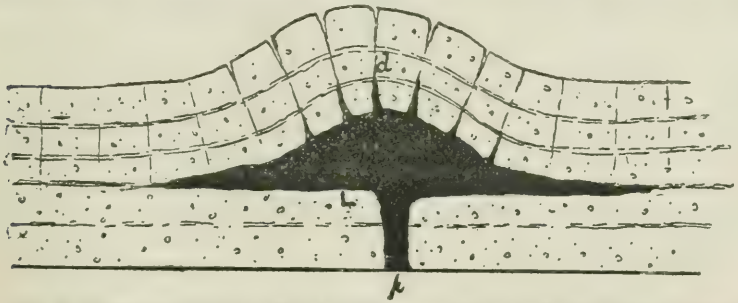

Fig. 10.—Diagrammatic Section across a laccolith. *L*, Laccolith or "stone-cistern," sending out veins and dykes into the overlying bulged-up strata, *d*.

rocks form conspicuous features in the lowlands of Scotland. These at the time of their intrusion were covered more or less deeply with sedimentary strata which they could not pierce, but may well have lifted up so as to cause prominent dome-shaped bulgings at the surface. But in the case of such ancient igneous rocks so long a time has elapsed since their intrusion that any superficial bulging they may have caused has utterly disappeared. Recognisable laccolith mountains are necessarily of recent formation.

In another article we shall consider the origin and history of Subsequent or Relict mountains.

PROFESSOR ERICH VON DRYGALSKI.

THE GERMAN SOUTH POLAR EXPEDITION.

By William S. Bruce, F.R.S.G.S.

On the 11th of August there set sail from Kiel an Expedition which bids fair to bring nothing but credit and renown to the great German Empire. Towards this Expedition, I am informed, the German Government has voted the sum of £100,000, or considerably more than twice the amount voted by the British Government for the British Expedition. There is no doubt that the Kaiser himself has been largely instrumental in inducing his Government to back up efficiently a project recognised, not only by the savants of Germany but also by those of the whole civilised world.

On the invitation of the "Reichsamt des Innern," as well as by the personal request of Professor Dr. Erich von Drygalski, the leader of the Expedition, I was present at the departure of the *Gauss*. I had previously become well acquainted with the ship and its outfit, as well as with the members of the scientific staff and the officers. One of the features of the German Expedition is the efficiency of its staff and the long and careful training its members have had. The appointment of the leader and staff was one of the first steps taken in the organisation of the Expedition, and the leader from the outset has been the chief organiser of the Expedition.

Professor von Drygalski is a scientific man of the highest rank, and, on account of several publications, is already of world-wide repute. Erich von Drygalski was born at Königsberg, in Prussia, on the 9th of February 1865, and received his education in Königsberg, Bonn, Leipzig, and Berlin. He graduated at Berlin in 1887, and attached himself to that University and Leipzig. He was especially associated with Professor Ferdinand Frhr. von Richthofen, who, it may be mentioned, has been one of the leading spirits in organising this Expedition. In 1891-1893 Drygalski successfully led the two Greenland Expeditions of the *Gesellschaft für Erdkunde* of Berlin, and was working at the results of these till 1898, in the University of Berlin.

In this work he gained for himself a foremost place as a physical geographer and as a master of many of the problems connected with ice. In 1899 he was appointed Professor-extraordinary in Geography in the last-named University. As leader of the German Expedition we have therefore a man who has already won his spurs as a scientist, and one who, from practical experience, has an intimate knowledge of the work he has to undertake. That he is a leader of men, is already proved in his Greenland Expeditions and in his splendid organisation of the German South Polar Expedition and its staff. In spite of the many things to think of and to do at the last moment before the departure of the *Gauss*, von Drygalski remained cool, collected, and concentrated, and any one could see that this man, with all his geniality, was able to command the respect of every one in the ship's company.

Besides the leader there are four other members of the scientific

staff attached to the ship. These have each had about eighteen months to prepare themselves and to help in organising the equipment of their respective departments. Professor Dr. Ernst Vanhoeffen, of Kiel, who is already well known as a biologist, not only in connection with Kiel University but as a specialist in coelenterata and in connection with his work on the collections of the German Greenland Expeditions already referred to. More recently, too, he has also come to the front as one of the naturalists of the German Deep Sea Expedition (*Valdivia*) under the direction of Professor Chun. Dr. Vanhoeffen sails as biologist, and his previous extensive experience makes him an expert in the work of such an Expedition. The other three, Dr. Philippi (geologist and chemist), Dr. Bidlingmaier (meteorologist and earth magnetist), and Dr. Gazert (medical officer and bacteriologist), are new to expedition work, but their previous careers and the long and careful training they have all undergone, make it certain that they will do their work well. As an example of the aptness and carefulness of the preparation, it may be mentioned that the geologist last year spent a considerable time in Scotland working up, under the guidance of Sir John Murray, the nature and distribution of deep-sea deposits, making a special study of those of the *Valdivia*.

The master of the ship is Captain Hans Ruser, of Hamburg. To him and four officers, including the first engineer, Mr. A. Stehr, are intrusted the management and navigation of the ship. Messrs. Lerche, Vasel, and Ott are respectively first and second officers, and there are twenty men forming the crew.

The *Gauss*, named after the great magnetist, is a three-masted topsail schooner. She is 151 feet between the perpendiculars, draws 18 feet, has 1450 tons displacement, and 300 indicated horse-power. The engines are auxiliary, ensuring a speed of seven knots. She has been built at Howaldt's works, Kiel, having been designed with the advice of the Construction Department of the Imperial Navy. Two objects were held in view in her construction, each being of equal importance, namely, that she should be sufficiently seaworthy to withstand the high seas and heavy weather of the South Atlantic and South Indian Oceans, and that she should be sufficiently strong for ice navigation. As I am familiar with both ships, it may not be uninteresting to offer a comparison between the *Gauss* and the *Discovery*. In general internal structure they strongly resemble one another, but in external appearance and in the arrangement of laboratories, saloon, and cabins the two ships are markedly different. The *Gauss* reminds one very forcibly of the *Fram*, though she has rather a fuller form than that vessel to make her the more seaworthy.

Each is strengthened with a system of internal supports and by three external plankings of oak, pitchpine, and greenheart, the latter being outside, as it polishes rather than tears when rubbed by ice. Inside the timbers is a fourth planking. In all, the thickness of the sides of the *Gauss* including timbers which are very closely placed, varies from 28 inches at the keel to 31 inches at the water-line. Like the *Discovery*, she is built especially for magnetic work, and has an area of

30 feet radius from the magnetical table, without any iron in the ship's structure, every bolt or fixing being of brass. In this respect both vessels are markedly different from that required for the Scottish Expedition, which emphasises oceanographical rather than magnetical work. The bow of the *Gauss* may be said to be spoon-shaped and in profile is convex in its entire extent, the perpendicular tangent not occurring till the jib-boom is reached. On the other hand, the bow of the *Discovery* is, if anything, rather more pointed, and in profile is convex in its lower portion and concave in its upper portion, the concavity commencing below the water-line. The stern of the *Gauss* is very similar to her bow and is deeper than in the *Discovery*, which has an elliptical stern, after the British naval pattern. The deeper stern will, I believe, prove to be more serviceable than the elliptical in ice navigation. On the whole, I should say the *Gauss* is the more ice-worthy and the *Discovery* the more seaworthy boat, and that in heavy pressure or in advancing through ice that the *Gauss* will rise more easily than the *Discovery*. Both ships are, however, untried, and it remains to be seen whether this conjecture is correct.

For scientific purposes the *Gauss* may be said to be divided into three parts: forwards biology, midships magnetism, and aft oceanography. She is three decked: first, the bridge and the after-bridge; secondly, the main deck; and thirdly, the 'tween decks. The bridge is T shaped, the perpendicular part of the T forming the roof of the main deck laboratory, gangway to 'tween decks, and chart-room. As is usual, the navigation of the ship is conducted from the bridge which also serves as the magnetical observatory. I believe, in severe weather, if the ship winters, it will be found necessary to have more protection against cold than is now afforded to the magnetist and his instruments. The object, however, in having the magnetical table here is to have it as far as possible away from the main mass of the ship. The after-bridge is just forward of the funnel over the stoke hole, and is to be used for sounding purposes—a Sigsbee machine being to port and Lucas to starboard. On the after-part of the fiddle a windmill is being erected for generating electricity, which can also be produced by steam-power. On the poop is a second steering compass and wheel, and the well for rudder and propeller. On the main deck partly under the foc'sle head is the winch and wire for dredging, trawling, netting, etc., the derrick being on the port bow just aft of it. Thus the forepart of the ship will be used mainly for biological operations. Then come three deck houses, two small ones to port and starboard supporting the transverse ends of the bridge and forming a lamp and store room, and 'midships extending as far aft as the mainmast is the third, which consists of the deck laboratory, gangway to 'tween decks, and chart-room. This house is 26 feet by 9 feet, and the anterior 18 feet of it forms the large laboratory well lighted with 8 port-holes and electric light. Here microscopic, chemical, physical, biological, and bacteriological research will be carried on, four or five men being easily accommodated at a time, and the laboratory being made comfortable by hot-water pipes. Entering the gangway between this laboratory and the chart-room one goes down below into the 'tween

decks. Immediately below the deck laboratory is found another one exactly similar in size, and used mainly for less delicate scientific work. Adjoining is the photographic dark room fitted up with all the modern requirements of photography. On each side and forward of this laboratory are the crew's quarters, while the saloon, scientific staff, and officers are accommodated 'midships, and on each side of the engine room and galley, just aft of the lower laboratory. In the after part of this section of the ship is a special room for oceanography, where all deep-sea instruments, thermometers, water-bottles, etc., are kept ready for use at a moment's notice. The rest of the vessel is used for storage purposes, coals and food taking up by far the greatest space. The dogs will be accommodated under the foc'sle head, and their food under the poop, where also alcohol and formolin find accommodation. Hydrogen in iron cylinders and other balloon material are stowed aft, and take up a great deal of room. It will be interesting to see how far a balloon can be worked from the ship. Besides dogs, buoys for nets, Hjort's net, paraffin, etc., form the deck cargo: two kites are also in readiness for immediate use for meteorological investigation.

A word as to living-accommodation, which again differs from that on board the *Discovery*. The men's quarters in each ship are forward and resemble one another. But those of the staff and officers differ; the *Discovery* having a central saloon with all the cabins opening into it, and the *Gauss* having the saloon separated from the cabins by a gangway on all sides save one, where, out of necessity, the first officer's cabin enters it. This reduces the size of the saloon but increases the amount of privacy for each of the members of the staff. Each cabin is fitted much the same in both ships. The saloon, though smaller than on the *Discovery* for the reason stated, is sufficiently roomy and tastefully decorated. It is pannelled; there are comfortable fixed couch seats, where the staff can sit or lounge, besides individual seats. Musical talent, so characteristic of the German race, is well represented, several members being able to sing well and play; there is a piano, guitar, and zither, and possibly other instruments may appear during the voyage; on the walls are portraits of the Kaiser, Gauss, Bismarck, and two tropical oil paintings. The library is extensive, in part round the saloon, in part on an upper shelf in the 'tween decks gangway. Prominent among the works of reference is a complete set of the *Challenger Reports*, presented to the Expedition by the British Government.

The work of the German Expedition will be divided into three parts: one carried out on board during the voyage, and the other on shore during the winter quarters, and the third at a station at Kerguelen. After leaving the Kiel canal and the mouth of the Elbe the *Gauss* will proceed by way of Cape St. Vincent and Ascension to Cape Town. Here, not unlikely, a meeting may take place with the *Discovery*, though the latter may arrive a few days earlier; after that the *Gauss* will steer for Kerguelen, the headquarters of the German Expedition; here von Drygalski expects to meet a transport ship that will bring Welsh coal supplied by the British Government, and fifty sledge dogs from Eastern Siberia; beside the staff and outfit for a scientific station to be established

at Kerguelen. Dr. Enzenberger, till lately in charge of the meteorological observatory on the summit of the Zug Spitz, by Munich, at an elevation of 10,000 feet, will be in charge of this station, and with him will be Dr. Luyken and Dr. Werth, and two seamen. The main work of this station will be meteorology, but other branches of scientific investigation will also receive attention.

The projected route of the Expedition is of importance with regard to the first part of the work. "It is intended to enter the Antarctic from the direction of Kerguelen, and the details of the route, particularly the deviations from a straight course, are planned with regard to oceanographical, geological, and magnetic requirements. The oceanographical considerations are the existing lacunæ in our knowledge of the depths of the sea; the geological are the collection from various island groups of specimens for comparison with those obtained in the Antarctic; the magnetic conditions make it desirable to cut the lines of equal value of the various magnetic elements in as many points as possible." Taking all these conditions into account, von Drygalski proposes "not to run directly south from Kerguelen, but first to sail eastward to about 90° E., and then turn towards the south, as on that meridian deep-sea soundings are wanting. For the same reason the route from Cape Town to Kerguelen would be curved southward between Prince Edward and Crozet Islands, while on the other hand, on the return voyage the line between South Georgia and Tristan da Cunha will be straight, because it is desirable to investigate the southern extension of the great Atlantic rise."

Von Drygalski intends to penetrate the Antarctic region at the point of the still hypothetical Termination Island in order to discover the western side of Victoria Land, and to clear up its possible connection with Kemp and Enderby Land. He believes that taking this route he may ultimately be able to sweep westward by a high southern latitude into the South Atlantic and emerge by way of South Georgia.

The second part of von Drygalski's programme is "the establishment of a scientific station in the Antarctic, at which a full year will be spent in geographical and biological work, and which will serve as a starting-point for longer or shorter land-journeys. It is, of course, impossible to say where this station will be, as the site must depend on the results of the discoveries made in pushing southwards. An effort will be made to establish it on the west side of Victoria Land, where one may expect to find an extensive land surface which will offer a favourable opportunity for carrying on various researches; such a position would be particularly desirable for magnetic observations, on account of its proximity to the south magnetic pole, and for co-operation with the British Expedition, which intends to land some of their party on the eastern coast." I believe that it is very probable that on this coast von Drygalski will find a place where it will be more easy to penetrate into the interior of the Antarctic continent than any place yet known. But as von Drygalski says, "What will actually be done must naturally be decided on the spot. The members of the Expedition must be so prepared that they can distinguish the important from the

unimportant, and the necessary from the merely desirable; in a word, the purely Antarctic, if one may say so, from what could be carried out equally well in other parts of the world." And there is no doubt that in this he will realise his object as nearly as it is possible, for a more carefully prepared and experienced staff never set sail before.

It is not necessary to reiterate what has been said by von Drygalski, by Sir John Murray, and by many others what the work of a modern Antarctic Expedition must be. The German Expedition will undertake as much of this work as possible, emphasising the purely geographical, geological, magnetical, and meteorological side as well as the biological, where this does not involve deep-sea investigation. It is not the intention of the Germans to carry on deep-sea investigation to any extent. Indeed, at one time it was intended only to carry 500 fathoms of cable for dredging. Now it has been extended to 2000 fathoms, but that will certainly not reach the bottom in many parts which they intend to visit. Hence the importance of co-operation on the part of the Scottish Expedition, one of the chief objects of which will be to "devote its attention more especially to physical and biological oceanographical researches"[1] in the greatest known depths of the Antarctic Ocean. For in the Weddell Sea Ross sounded and got no bottom with 4000 fathoms, and the soundings of the *Valdivia* help to bear this out. In meteorology, too, there will be a very close co-operation on the part of the four Expeditions.

The departure of the German South Polar Expedition marks an era in the rapid development of the German Empire. It is the greatest geographical undertaking that Germany has ever set her hand to, and to all appearances she will rise to her task as a giant among nations. As we have stated she will not be alone in the work. Already an Expedition representative of the British Empire has set sail on the same mission, and next year Sweden and Scotland will also be represented. Rivalry there will be; but it will consist in the endeavour of each Expedition to obtain the best possible scientific results. There will be co-operation as well as division of labour: while Sweden will specialise on the geology of Terre Louis Philip, and Scotland on the deep sea investigation and meteorology; the German and British Expeditions will devote special attention to magnetism. In all of them purely geographical work will necessarily form an important feature.

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THE WORK AND EQUIPMENT FOR EARTH MAGNETISM AND METEOROLOGY OF THE GERMAN SOUTH POLAR EXPEDITION, AND SUGGESTIONS FOR INTERNATIONAL CO-OPERATION DURING THE TIME OF THE SOUTH POLAR RESEARCH, 1901-1903.

By Dr. Fr. Bidlingmaier.

At this time, when the German South Polar Expedition is on the point of leaving home, it would be of interest to give an account of the work to be done in Earth Magnetism and Meteorology by the Expedition, and also the equipment at disposal, and further, to discuss to what extent an international co-operation is practicable during the period of South Polar research.

Germany will set up two stations for the year 1902-1903, namely, a chief station in the Antarctic regions, with Dr. Fr. Bidlingmaier as observer, and a branch station on Kerguelen Island, with Dr. Karl Luyken as observer.

I. The Magnetic Work.

1. *Ship's Observations.*—During the journey, both to and from the Antarctic, every day as far as possible a complete determination of all three elements will be taken. Besides, through complete deviation-determination, before the departure, off St. Vincent, off Ascension, Cape of Good Hope, Kerguelen, and in the Antarctic, the influence of the ship's body on all three elements will be fixed.

Instruments.—(1) A strongly built swinging table to stand on the bridge: (2) a Fox apparatus of the Captain Creak pattern, Admiralty, London; (3) a complete deviation-magnetometer, by Bamberg; (4) a normal compass of the first grade, and a steering compass.

2. *Observations on Land.*—At both stations (1) the progress of all three elements will be followed for at least a year by means of photographic registration and directly by variation instruments. (2) The record of the variation instruments will be controlled as occasion demands by absolute measurement and reduced to absolute scale. (3) By journeys from the station the neighbourhood will be measured magnetically.

Both stations are furnished with a variation house, in which particular care will be taken to preserve a constant temperature: and a small house for absolute measurements. Both stations are provided with the following instruments: (1) A magnetic theodolite, by Tesdorpf in Stuttgart, with a swing box and an inclinator for the determination of total intensity. This is the chief instrument of the Antarctic station, and there is none at Kerguelen. (2) Another of the same, but simpler, and fit for taking on a journey. (3) An earth-induction instrument of the Wild pattern by Schulze in Potsdam. (4) Two sets of variometers for the three instruments, with accessories (Kerguelen, one set), by Töpfer in Potsdam. (5) Two registration apparatus to go two or twenty-four hours, with accessories. (6) A galvanometer.

3. In connection with the magnetic work, possibly the following observations will be made: The electric phenomena of the air; the Polar lights, their form, changes, and height, spectrum. Instruments provided: (1) Several Exners electroscopes; (2) a complete distribution apparatus after Elster and Geitel; (3) two simple theodolites with adjustment for parallax determination; (4) a complete spectograph.

II. The Meteorological Work.

1. *The Ship's Observations.*—Will be taken in the usual way once every watch. Besides, atmospheric pressure, temperature, and humidity will be continuously registered. For the investigation of the higher strata of the atmosphere kites will be employed, with the usual self-registering apparatus.

2. *Observations on Land.*—To be carried on at both stations. Direct observations to be made at three fixed periods every day about 7 A.M., 2 P.M., 9 P.M., local time, and observations of all branches of meteorology, according to necessity, wind, clouds, sky, etc. (2) Continuous record of atmospheric pressure, temperature, humidity, and duration of sunshine. (3) By means of kites at the Antarctic chief station, as far as is practicable, atmospheric pressure, temperature, humidity, direction and strength of wind of the upper regions will be observed.

The Antarctic head station is provided with the following instruments, while the Kerguelen station has the same sort of instruments nearly though not all of the same kind.

(1) Atmospheric pressure.—Two ship's barometers, a normal and a

station barometer, each with a reserve tube; two aneroidbarographs to go for seven or two days; five aneroids of different degrees of sensitiveness; a thermohypsometer, with several reserve thermometers.

(2) Wind.—Four pocket anemometers; two wind vanes, with strength indicators.

(3) Temperature.—Twenty Schleuder thermometers; twenty Psychrothermometers, with mercury and alcohol; fifteen maximum and fifteen minimum thermometers; a set of ordinary ground thermometers for depths of 5, 20, 50, 100, 200 cm.; a set of electric ground thermometers; three common black bulb thermometers; three black bulb thermometers as maximum thermometers; an aspiration psychrometer, with accessories; two thermographs to go for seven and two days.

(4) Humidity.—Two capillary hygrometers (Koppe); a Lambrecht polymeter; two hygrographs (Richard); two condensation hygrometers (Lambrecht).

(5) Sunshine duration.—Two sunshine self-registering apparatus, one of Campbell-Stokes pattern, the other of Jordan pattern.

(6) Kite observations.—A number of kites, of Hargrave and Eddy types; two meteorographs of Marvin type: two baro-thermo-hygro-anemo-graphs by Richard.

(7) Measurement of height of clouds.—Two simple theodolites.

For the German and the simultaneous English South Polar Expeditions, international co-operation has been suggested, and after agreement between a German and an English committee, the following programme has been drawn up.

III. Programmme for the International Co-operation in Earth-Magnetism Observations.

1. The object of this is to furnish science with a large number of details sufficient to permit of a study of the changes in the magnetic condition of the earth in its totality over a given fixed period of time, and which will lay the foundations from which alone we can hope to settle the fundamental questions of earth-magnetism.

2. The stations for observation which intend to co-operate are distributed all over the whole world with a uniformity never attained till now.

3. The observations are all to be simultaneous over the whole world. They are of two kinds. These are: (1) observations of the three elements for a whole hour on certain fixed days in order to get a view of the progress of the daily variation of the whole magnetism of the earth; (2) close observations of the three elements during a fixed hour of each day fixed on, in order to follow the progress of the individual disturbances.

4. All observations will be made by means of Greenwich time at all the co-operating stations.

5. It is desired that the electric phenomena of the air and the aurora be carefully noted on the days fixed on, and that the observations be entered up on the observation-sheets under the heading "Remarks."

6. The office of the Seventh International Geographical Congress at Berlin will provide all co-operating stations with a sample of the observation formula, and recommends its universal adoption.

IV. Programme for the International Co-operation in Meteorological Observations.

1. The object of this is the construction of a synoptical weather chart of the as yet little-known southern latitudes for every day in the periods of time agreed upon, an object of particular importance from a theoretical as well as a practical standpoint.

2. All co-operating stations south of 30° S., all states with permanent or temporary meteorological observatories south of 30° S., all states and commercial bodies whose ships will be at sea south of 30° S. during the period fixed upon are requested to see that meteorological observations be taken from 1st October 1901 to 31st March 1903, every day at mid-day by Greenwich time.

3. The observations to be confined to precise records: (1) of the time of observation (local time); (2) place of observation; (3) atmospheric pressure; (4) air temperature; (5) strength and direction of wind; (6) the clouds, kind, amount, and arrangement. With regard to the latter point, the higher clouds (Cirri) are particularly to be noted.

4. The office of the Seventh International Geographical Congress should provide all the states co-operating with a sample of the observation formulæ and the notation to be employed, and recommend its general adoption.—*Petermann's Mitteilungen*, July 1901.

THE BACTERIOLOGICAL WORK OF THE GERMAN SOUTH POLAR EXPEDITION.

By Dr. Hans Gazert.

The extraordinary important rôle which micro-organisms play in the economy of nature makes it desirable, that these minute though vastly important creatures should not be overlooked among the biological investigations of the German South Polar Expedition. The most important function they perform is the destruction of decaying organic material, and the conversion of it into that form which best serves to nourish plant life, and thus indirectly all organic life. To what extent this destructive process goes on in the Frigid zone is the chief object of investigation of the bacteriologist of the expedition. The notion that the low temperature of the Polar regions hinders the growth of bacteria is only partly correct. Ships have many a time come on the dead and highly decomposed bodies of whales, and have noticed the presence of skeletons in Polar regions. The decomposition of the flesh of animals that have been slaughtered has been noted by many expeditions, and goes to prove the presence of microbes. It is quite inconceivable that they could be absent in a region with a rich growth of vegetation as in the north of Greenland and in Spitzbergen, where, indeed, large carnivores,

reindeer, and musk oxen have their habitat. Nordenskjöld observed in 1870 the decomposition process going on, which made itself manifest by an unpleasant odour, away in the eternal ice of the interior of Greenland, where the dust and the snow-alga had collected, especially in places where large heaps were swept together. These observations agree with the results of Forster and B. Fischer in their researches on the growth of bacteria in low temperatures. They found numerous species which could thrive at 0° C., and the growth of which was limited only by the freezing of the medium. Levin, who accompanied Nathorst on the summer expedition to Spitzbergen and King Charles Land in 1898, found bacteria in sea water of −2° C., and there is no doubt that these bacteria were not in a transitional latent condition, but performed all their functions, although quantitatively much weaker than in warmer surroundings. The only bacteriological investigations of any value in the Polar regions were undertaken by Levin and Blessing, if I may except the work of Nyström on board the *Sofia* in 1869, which was done with the usual inaccurate methods of his time. Blessing, the medical officer of Nansen's staff, appears to have devoted himself latterly to the germ contents of the air only, whereas Levin extended his observations to the ice and sea water. The air[1] was found to be practically free from germs, and the sea water and pools on the ice had but few. Every expedition has observed how pure the air is; and from the fact that men seldom or never catch cold there, Nordenskjöld has suggested that the Polar regions ought to be made use of, as a suitable place for the erection of sanatoria for invalids.

The presence of bacteria has been observed during the Polar summer, and it is more reasonable to suppose that they have survived the winter in spite of its length and its severity, than that a new crop should turn up every year, carried by the wind. Our water bacteria can remain a long time in ice and retain their vitality; and, in fact, Schmelck found bacteria in the ice of a Norwegian glacier. According to Pictet, many bacteria can endure extreme cold up to −200° C. without any harmful results.

Bacteriological investigations of the kind initiated by Levin must be extended. With the help of Koch's methods, the germ life of sea water of different depths, of bottom samples, of the air, of the ice, of the pools on the ice, of the soil, and of the fresh water on land, must be studied as far as possible in the same locality in the different seasons of the year. The examination of anaërobic bacteria must not be neglected, since they do not appear to have been investigated, especially in sea water and in

[1] Rawitz, during the German Fishery Expedition to Bear Island in 1899 (vide *Deutsch. med. Wochenschr.* 1900, Nr. 13), observed that, as long as the air was clear and dry, fish did not become putrid and had no smell; so also for fæcal matter. In misty weather both became putrid. He concluded from this that in the first case the air was free of germs, and in the second that the air was charged with germs. According to my opinion, this conclusion is not correct. For the dry air gradually prevented the growth of the bacteria present, through the rapid superficial drying up of the medium. As soon as the fish, etc., became moist owing to the foggy weather, the conditions were again favourable for the increase of the bacteria, and hence putrefaction arose.

bottom samples. Observations on the sea water can be made on the voyage to the Antarctic in the different seas, wherever hydrographical work will be taken up. The results will furnish a desirable contribution to the bacteriology of the sea, which has been worked up by Russel, San Felice, and above all by B. Fischer during the German Plankton Expedition. Their observations lead to the following results:—That germ life is more abundant in fresh water than in the sea; that it diminishes in quantity from the coast towards the high seas, and from the surface downwards through the layers of water to the depths. That the sea bottom at inconsiderable depths is rich in germ life, and that water and bottom samples from great depths are either very poor or entirely free of germ life. Through Bachmann's researches, as Chun has pointed out in his account of the German Deep Sea Expedition, bacteria have been recorded from the greatest depths, and it is greatly to be regretted that Bachmann's sad fate should have terminated his investigations on this subject.

We will not attempt the investigation of the morphological relationships of the micro-organisms to the different media they are found in. The difficulties would be too great to permit of results sufficiently accurate. Such investigations will be carried out in the laboratory, after the return of the expedition, as far as it is possible, with pure cultures made for the purpose. On the voyage, it will be sufficient to take note of what strikes the eye of the observer when the microbe is isolated, *i.e.* to find out to what group it belongs, and whether it forms colouring matter, or acts on gelatine, or whether it forms colonies, or if luminous in the dark, etc.

Perhaps observations will be set on foot on the physiological activity of bacteria. We owe much of our knowledge of the nitrous and nitric bacteria to the researches of Winogradsky, Hueppe, and others. Ersterer found them in the soil of all parts of the world; and Müntz has recorded them from the naked rock surface of the Faulhorn. In Polar regions and in the sea, observations on their activity are still unrecorded.

Brandt, in his paper "Ueber den Stoffwechsel des Meeres," has pointed out the activity of the nitrification bacteria, and in particular the important rôle played by denitrification bacteria in sea water. To them must be attributed the important task of setting free again the great mass of nitrogen which is brought into the sea by rivers in the form of ammonium salts, nitrates and nitrites. Brandt has calculated that without their activity, in the space of a thousand years, a concentration in the sea water of those above-named salts would take place sufficiently strong to be harmful to the life of organisms.

Owing to the striking fact "that the Arctic regions in summer are very rich in plankton, and the tropical regions, on the contrary, very poor the whole year round," Brandt comes to the conclusion that the activity of denitrification bacteria is far greater in warm seas. In consequence of this activity, the quantity of the above-mentioned salts in the sea water is smaller and makes the Tropics less suitable for the growth of plankton. With the growth of plankton in the Arctic regions, the forms of animal life, which directly or indirectly are indebted to it for food, naturally keep pace; and thus we see that the activity of the nitrification and the slight and dwindling, if not absolutely absent,

activity of the denitrification bacteria, virtually brings it about that mankind may make a livelihood in the Polar seas which would otherwise be quite worthless. Through the cultivation of such bacteria on suitable media, perhaps this theory of Brandt's may be substantiated.

I must not omit to mention a number of observations made by Levin on the contents of the intestines of different animals belonging to the Polar regions. He found the intestines of several birds and seals absolutely sterile, nor could he detect bacteria by cultivation under the microscope. He correctly attached importance to his discovery, since the necessity for the presence of bacteria in the intestine has not been clearly demonstrated. Experiments have been attempted with animals taken out of the mother, sterile, and placed in sterilized dishes, provided with sterilized food to try and settle this question. It is therefore particularly interesting to find out whether there really exist in nature animals with no bacteria in their intestines. Observations of this kind on Antarctic animals, as well as deep-sea animals where similar temperature conditions prevail, will be part of the bacteriological work done by the expedition.

I have attempted to give an outline of the kind of problems to be solved in the frigid zone in the realm of micro-organic investigation. How far these are practicable on the voyage is certainly not easy to say; for the limited room at disposal, the stormy seas of the Antarctic, and many accidental circumstances will interfere with the progress of the investigations. The greatest enemy of the bacteriologist is mould, which has caused many a one great trouble, especially Dr. Bachmann during the Deep Sea Expedition. It very commonly destroyed his observations, for, in spite of careful work, the spores of the fungus everywhere present all over the ship, found their way into his cultures and made further investigation impossible by their growth.—*Petermann's Mitteilungen*, July 1901.

ANTARCTIC CLIMATE.[1]

Those who would undertake researches into the climate of the Antarctic regions must not expect to fulfil the strict demands of scientific method. The Argentine Staaten Island, which is the most southerly station in which observations have been prosecuted for several years, is situated in 54° 23′ S., that is, approximately, in the latitude of Kiel; and in the eastern hemisphere, in New Zealand, the outpost of observation lies in a latitude corresponding to that of Trieste. Kerguelen (49 S.) and Auckland (50½° S.) afford only interrupted records, extending over a few months at a time, from which it is only possible to infer, indirectly, approximate estimations of the mean annual temperature. Conditions are somewhat more favourable on the American side; for here observations extending over a whole year have been carried out at Cape Horn and in South Georgia; and the records from these two stations gain

[1] Translated from an article by Professor A. Supan: *Petermann's Mitteilungen*: pp. 128 ff. 1901.

special importance from the fact that they were secured simultaneously. But beyond 55½ S., corresponding to the latitude of Copenhagen in our hemisphere, there begins an area quite unknown to climatologists, except for isolated observations taken on board ships.

Yet certain climatological characteristics of the higher latitudes of the temperate southern zone are apparent: the comparatively slight variation of temperature throughout the year; the low atmospheric pressure, and the marked predominance of strong westerly and north-westerly winds associated with frequent precipitation.

For the 50th degree of latitude Spitaler's tables give the following records of temperature:—

For the year, .	N. 5·6	S. 5·9
For the warmest month,	18·1	8·1
For the coldest month,	−7·2	3·2
Range of temperature,	25·3	4·9

The contrast between the hemisphere which is predominantly land and that which is chiefly sea finds a very clear expression in these figures. But the same contrast between north and south, though considerably diminished, is evident even in a purely sea climate, far removed from continental influences; as may be shown, for the 50th degree of latitude, by the selection of a Pacific and an Atlantic meridian from Spitaler's tables:—

	170° W.		30° W.	
Year,	N. 8·0	S. 8·0	N. 10·7	S. 3·8
Warmest month,	12·7	11·0	15·0	7·5
Coldest month,	2·0	3·4	6·6	1·7
Range,	10·7	7·6	8·4	5·8

This example has also been chosen for a further purpose: it shows that a similar extent of ocean does not prevent considerable thermal differences at one and the same degree of latitude. Even Cook, the pioneer in the southern polar regions, remarked that the drift-ice was met with in higher latitudes in the South Pacific than in the South Atlantic, or in the South Indian Ocean. Now, the absence of ice in the South Sea, say, at the 50th degree of latitude, is not due to the warmth of that region; on the contrary, it is warm there because of the lack of ice. The equatorial curves of the isotherms are ultimately dependent on the corresponding curves of the average limit of drift-ice. The projection of cold in the South Atlantic is especially striking, our accurate knowledge of which is one of the results of the international Polar research of 1882-83. Mention has already been made of the simultaneous observations at Cape Horn and in South Georgia. Their value for comparison is guaranteed not only by the similarity of the methods of observation, but also by the fact that at both stations, as also in the Falkland Islands, June was, abnormally, the coldest month. They also belong, with the possible exception of spring, to one and the same meteorological region. The results of the observations of temperature, in the reading of which it must be remembered that South Georgia is one degree nearer the Equator than the other much warmer station, are as follows:—

	Cape Horn.	South Georgia.
Year,	5·4°	1·4°
Warmest month,	8·7	5·4
Coldest month,	2·1	−2·9
Absolute maximum,	24·3	17·8
Absolute minimum,	−7·0	−12·3

The fact that South Georgia is relatively colder in winter than in summer, and that it has a greater yearly range of temperature than is experienced at Cape Horn is of importance in the estimation of the thermal difference. The contrast of purely oceanic and continental situations does not therefore afford an adequate explanation. The great development of glaciers in South Georgia may indeed depress the temperature occasionally, but it must not be forgotten that the winds from the mountains often develop into the Föhn, and thus actually contribute to raising the temperature in Moltke-Hafen. That the harsh climate of South Georgia depends on general causes is shown also by the fact that in the same latitude, but in the more easterly-lying Bouvet Island, that the German *Valdivia* Expedition rediscovered, the glaciation is still more marked than in South Georgia, although it is 1000 metres lower. It must also be noted that the temperature falls to 0° C. But how it happens that the drift-ice and isotherms bend so much towards the Equator can only be left to conjecture. Certainly the ice comes from a great distance, as is proved by its extremely weathered aspect; while the icebergs that the *Valdivia* Expedition met with east of 40° E. on account of their fresh appearance had their origin in the neighbourhood.[1] It is also well to note, that in the latitudes of the South Atlantic the Polar currents are more strongly developed than elsewhere, and perhaps the next South Polar Expedition will succeed in enlightening us upon this entirely obscure condition. The widely distributed, and, in comparison to the northern hemisphere, enormous decrease of atmospheric pressure in the south, in conjunction with the already mentioned condition of wind, led Hann to state, even in the second edition of his *Climatology* in 1897,[2] that the whole south Polar region represents a great cyclone, whose centre lies at the Pole. Theoretical reflections have strongly influenced this decision. Meanwhile Hann had already called attention to the fact that according to Ross's observations the atmospheric pressure beyond the 70th parallel rose again; connected with this is the repeatedly established fact that in the highest southern latitudes reached easterly and southerly winds replace westerly ones. Of the greatest importance are the observations of the *Valdivia* expedition in the summer of 1898, which show that the belt of strong west winds and low barometric pressure south of Africa only reaches to 55° S., and to the south of Kerguelen to 56½° S. where there is a calm belt, with light variable winds, and finally at 60° S. there are easterly winds. Here for the first time the barometric depression, of which I shall speak later.

[1] *Zeschr. d. Berliner Ges. f. Erdk.*, 1899, Heft 2 (S.-A., p. 95).

[2] Bd. iii. p. 544.

was identified and located, but there must always be a doubt whether we have to do with a normal condition in this case.

In order to obtain a representation of the state of temperature within the Polar regions Hann and Ferrel have tried to deduce mathematically means from observations in lower latitudes. Ferrel found for 70° S. an annual temperature of 5·8° C., Hann one of 4·8° C. The comparison with the mean temperature of 70° N. is interesting:

	N. — 10·2° C.	S. — 4·8° C.
Year,		
Warmest month,	6·8°	— 0·4
Coldest month,	— 26·1°	— 9·1

The southern hemisphere thus appears extraordinarily favoured; the summer is indeed cold, but this condition, on account of its mild winter, is more than compensated for. In other words, this antithesis between the water and land hemispheres, that undoubtedly holds good in high temperate latitudes, is simply repeated in the Polar zone.

And now we put the question: In what directions have the most recent annual observations of the Belgian South Polar Expedition from March 1898 to February 1899, and the English Expedition from February 1899 to January 1900, confirmed or modified our views?

He who knows how long and how eagerly we longed for one glance into that mysterious world at the South Pole, knows best how to estimate with what enthusiasm, and, it is not too much to say, with what awe we received the first entire year's records in meteorology from this region. For all that, we must not deceive ourselves in regard to their defectiveness. The *Belgica* had not at all foreseen a wintering, and was not so well fitted out with instruments as one might have wished. And, furthermore, she was subjected to constant movement after she was shut in the ice, but, fortunately, more in longitude than in latitude. The longitude varied between 80½° and 97° W., but the latitude only between 69½° and 71½° S. Taking the middle months' position one also obtains the average position of the *Belgica* as 70½° S., 86° W. Borchgrevink, the leader of the English Expedition, had exquisite instruments. He was able to erect a fixed station at Cape Adare, but the observations are, we can see, strongly tinged with local colour. The station lies in 71° 18′ S., 170° E., and is therefore somewhat more southerly than the *Belgica*, and it is situated just about one quadrant from it.

As a result of fundamental importance, I must first state that there is a permanent inner Polar anticyclone. Cape Adare stood throughout the whole year under the domination of southerly, south-easterly, and easterly, and therefore of truly Polar winds. In winter they reached 80 per cent., and in autumn, when they were proportionately least, still 62 per cent. of all the wind directions. Quite otherwise were the results of the *Belgica*.

	W. + NW. + N.	E. + SE. + S.
In winter,	52·8	27·2
In summer,	13·8	55·8

During the entire year Equatorial and Polar winds were almost equally balanced. In a word, the monsoon character is so typically shown that we may safely conclude that the *Belgica* observations are normal.

That is a result of more than mere climatic significance. If the surface of the Antarctic area were homogeneous, *i.e.* if the Pole were situated in the middle of a continent, or if there were only sea there, or at the most a few small islands, then the centre of the anticyclone would lie over the Pole, and the prevalence of Polar winds would extend uniformly towards all sides, and in winter naturally farther than in summer. The tables of the Belgian Expedition show us exactly the opposite result: in winter prevailingly Polar, in summer prevailingly Equatorial winds. But the anticyclone itself undergoes an annual change of position, it travels in winter farther towards the eastern hemisphere, and we can find no other interpretation than that a cold centre exists there. But we know that such a condition only prevails at a distance from the Pole when great land masses are present. Here, towards the Indian Ocean, where most continuous land has been found, the Antarctic continent must lie, and the ice-face to the east of Victoria Land that Ross discovered, and that Borchgrevink landed on, must certainly be the termination of a great inland ice-cap. Cape Adare therefore lies much nearer the centre of the anticyclone, and is even periodically drawn into it, as the prevalence of calms shows. 42·5 per cent. of all the observations are calms, whereas with the *Belgica* only 11·6 per cent. are calms. But in spite of this the English station does not belong to the high pressure area, but to the fringe of it. The means of atmospheric pressure are most unfortunately not published yet, but we know this much, that the barometer stood high, and, indeed, what particularly decides this question, higher in winter than in summer.

Characteristic also of Cape Adare is the variable force of the wind-rose—

From the	SW.	quadrant	3·5	metres	per second.
,,	NW.	,,	4·0	,,	,,
,,	NE.	,,	4·1	,,	,,
,,	SE.	,,	12·6	,,	,,

Often the Polar wind develops into the violence of a storm, and on one occasion the anemometer was broken in two. The air was dry, and what is most extraordinary, the temperature rose. The following example is characteristic. On the 1st of April at 9 P.M. there was a west wind with a velocity of 2·5 metres per second, and the thermostood at -11° C. On the 2nd of April an ESE. storm arose, and the velocity reached 36 to 45·5 metres, and the temperature at 9 P.M. had risen to $-2·3$ C. It stands to reason that the current of air originating from the ice-covered interior cannot be warm, but it could get warmed by descending movements. On placing all the experiences at Cape Adare together, the conclusion is reached that the south-east winds, under known conditions, probably on account of the steep gradients of the barometer, actually take on Föhn characteristics. The station lay on the west side

of the Cape in Robertson Bay, which is about 30 miles broad; beyond rises the rugged Admiralty range to 2000 metres (6500 feet). Over these mountains the volumes of Polar air fall, and are able to raise their temperature by about 20° C. The frequency of these Föhn storms has naturally strongly influenced the temperature curves. To this, for example, may be ascribed the rise in the curve in July, which was warmer than either June or August, and to a great extent the high mean temperature of January, viz., +0·5° C., if it is not possibly also influenced by the dark-coloured snow-free rocks of the precipitous slopes of the neighbouring mountains. Here in January away from the land the temperature is below 0° C., as we know from previous observations. Their true character compared with the Polar wind is revealed in the observations of the *Belgica*, and for that very reason we have lower summer temperatures here, viz., December −2·2° C., January −1·2° C., and February −1·0°. The rises here in the temperature curve are also the work of the Polar wind, but in quite another sense than at Cape Adare. The temperature falls at once as soon as these winds increase in frequency during seasonal transitions.

In spite of the temperature of the English station not being typical on account of the influence of the Föhns, because it is too high, yet it is, except in the summer, lower than that of the *Belgica*. The former has an annual mean of −13·8 C., and the latter one of −9·6° C. The difference may diminish in the mean of several years, but it must not be supposed that it will vanish. Neither is it explained by the difference of the latitude of the two stations which only varied by three-quarters of a degree, but it varies because Cape Adare lies much nearer to the Polar anticyclone, and gets laterally pulled into its reach. Besides, the Polar winds did not always have the characters of the Föhn. For the present we can take −11° C., the mean of the two sets of observations taken under such different circumstances, as the normal temperature for the 70th parallel of south latitude. That is very considerably lower than Hann and Ferrel calculated; the summer temperature approximately agrees, but the supposition that the winter is very much milder than in the northern hemisphere appears to be erroneous. The existence of an ice-covered continent and of a Polar anticyclone was not taken into account. But there is nothing striking in an annual temperature of −11° C. in 70° S. In 70° N. upon the Asiatic continent it sinks to −16·7° C., and in the interior of Greenland, after being reduced to sea-level, apparently to about −20 C. But the normal temperature of 70° N. amounts to −10·2° C., and we have not only to thank the Gulf Stream, but also the relatively enormous warm area of the North Atlantic Ocean, and its Arctic continuation, as exists nowhere else in the world. In our hemisphere there are much lower temperatures; the minimum of the *Belgica* was −43·1° C., at Cape Adare −41·7° C., but in East Asia the *mean* temperature of January sinks down to −43°. At the Antarctic stations the winter was not more severe than in the Kara Sea in a similar latitude. But the thermal gradient in the southern hemisphere is steeper: the temperature from 55° to 70° N. is not quite 1° C. for each degree of latitude, but in the south it is more than 1½° C. The out-

standing character of the Antarctic remains, however, in the cold summer and autumn. In Upernavik, in 72° 47′ N., situated on the west coast of Greenland, the most northerly station with several years' observations, the winter is not markedly warmer than at Cape Adare, but from June till September the temperature curve remains above the freezing point. The highest month's temperature in Upernavik is +5° C. at Cape Adare under the influence of the Föhn +0·5 C., on the *Belgica* −1° C. The highest temperature observed in Upernavik 17·8° C., at Cape Adare 9·4°, on the *Belgica* probably under 3° C. Even the *Fram* Expedition registered positive July temperatures +0·2° in 81° N., and −0·3° in 84° N., and these relatively high temperatures were not brought from the south, since the differences of temperature of the wind-rose, according to Mohn, allowed inferences of little importance to be drawn from them. In order to find such low summer temperatures as on the *Belgica* in our hemisphere, one must turn to the interior of Greenland. Land-ice manifestly behaves, contrary to accepted opinion, differently from sea-ice; perhaps on that account the latter breaks up into separate pieces in summer. If there exists, as we have every reason to suppose, an Antarctic continent in the highest latitudes with an ice-cap, possibly broken through with a few *nunataks*, then the two main factors which lower temperature unite here, viz., proximity to the Pole and land-ice, and we may expect to find here the absolute *Cold-Pole* of the earth.

Let us summarise what has been said so far. The inmost and still unknown part of the Antarctic is covered by an anticyclone, whose centre in winter lies more towards the Indian Ocean, and in summer more towards the Pole. According to all experience it is surrounded by a zone of low atmospheric pressure, a deep barometric depression or trough, which, of course, alters its position periodically. In the western part of the Indian Ocean the *Valdivia* Expedition determined the summer extent of the "trough bottom," if one may use the expression. The *Belgica* lay in winter on the Equatorial, and in summer on the Polar side of the trough. The station on Cape Adare lay persistently on the Polar side, and for a while, particularly in winter, within the anticyclone. The most southerly observations belong to the border-zone, and not to the actual Polar climate. Characteristic of this border-zone is the violence of the wind, which makes the cold so much felt, and the climate still more inhospitable than the North Polar world. It is the duty of the next Expedition to place their station as far as possible towards the south, not simply on account of the scientific interest, but also for this reason, that within the anticyclone they may expect far calmer weather.

I have already repeated in this magazine that the climate periods discovered by Brückner appear to hold good also in the South Polar regions. In the quinquennial period with the highest positive temperature anomaly shown on Brückner's Tables, falls the noteworthy journey of Weddell, who in 1823 in 30° W. pushed his way in a sea completely free from ice to 74° 15′ S.; the attempt, which was undertaken at the same place in the succeeding cold period in 1838 by Dumont d'Urville, and in 1843 by Ross, was completely frustrated by the unfavourable ice conditions. The observations which Ross took in the same cold period, in the middle

of January 1841, east of Victoria Land, between 70° and 74° S., showed a mean temperature of −1·3° C.; for the same region and for the same month the ship *Antarctic* in 1895 experienced a higher temperature, viz., a mean temperature of −0·2° C. The great ice face has during the last sixty years not only retreated towards the south, but has also diminished very considerably in extent. At the time Ross reached it, it had an elevation of 45 to 90 metres above sea-level. Borchgrevink found it on the contrary scarcely 20 metres high, and at one place he succeeded in landing on the upper surface of the ice without any difficulty.

I have only one wish still to express, namely, that the Scottish Expedition will succeed in establishing a Polar station in the meridian of America; the ring round the South Pole would then be wellnigh complete.

On the occasion of the departure of the German Antarctic Expedition the following telegram was sent to Professor Erich von Drygalski: "*Best wishes for prosperous happy voyage and safe return from the Royal Scottish Geographical Society.*"

FRANCE AND THE PENETRATION OF THE CENTRAL SUDAN.

(*Continued from page* 429.)

Rabah (or Rabih).

In the preceding account of M. Foureau's itinerary, allusion has been made to Rabah (or Rabih, as he signed himself), and in the following accounts of M. Joalland's and M. Gentil's itineraries further allusion will be made to the redoubtable potentate of the Central Sudan, who has been dubbed in France an 'Arab Napoleon.' It will be best to give here some details regarding him and his empire, which will elucidate the position occupied by him in relation to the Central Sudan and the French Missions.

Rabih was a half-brother of Zubair Pasha. In 1874 he was one of Zubair's lieutenants in the attack on Darfur, which secured that province for the Khedive. When Zubair was summoned to Cairo and detained there, Sulaiman, his son, became Governor of Shakka, but was deprived of his office by General Gordon and sent to the Bahr-el-Ghazal. In 1878 Sulaiman revolted, but was defeated by Gessi Pasha on January 14, 1879, at Dem Idris, and put to flight. When Gessi followed him up and called upon him to surrender, Rabih was the chief who refused and sought to dissuade Sulaiman. He proposed that they should retire west into Dar Banda, and, having dominated it, enter into relations with Wadai, Baghirmi, and Bornu. Sulaiman decided, however, to accept Gessi's conditions and to surrender. Rabih made a last earnest effort to persuade Sulaiman to reconsider his decision. Not succeeding in this, he collected his men and set out for Dar Banda.

Between that date and 1891-92 little is known of Rabih's movements and conquests. The scene of his parting from Sulaiman was in the south of Darfur on the borders of the Bahr-el-Ghazal. He then proceeded through Dar Fertit, reducing the Krej, the A-Banda of Dar Banda, till he came to the confines of the N-Sakkara territory. The Sultan of the N-Sakkara was Bali, the father of Bangaso, the present Sultan, and he was defeated by Rabih in a great battle at Baso, where the Zako falls into the Bali affluent of the Mbomu. Rabih would probably have followed up his victory over this well-organised state and penetrated to the Ubangi. But the dearth of provisions in the devastated country beset him with difficulties. Thereupon Rabih set out for the north-west, proceeding pretty much on the lines indicated in his counsel to Sulaiman. Passing beyond the Kotto he penetrated into the basin of the Shari, attacked and conquered Dar Runga. The Sultan of that state submitted, became his vassal, gave him one of his daughters as a wife, and handed over to him all his arms and ammunition. This event gave Rabih his footing from which to dominate the Sudan up to the Chad.

The date of this event is uncertain, but the probability is that it was antecedent to the arrival of Crampel, who started from the bend of the Ubangi in October 1890, reached El-Kuti, the capital of Dar Runga, in the following March, and was killed in May 1891. How far Rabih was implicated in this sad affair is uncertain, but it is said that the Sultan of Dar Runga presented him with 150 Martini rifles and other goods belonging to the Crampel Expedition. As the Sultan of Dar Runga, Es-Senusi el Bekir, was a vassal of Wadai, and Yusuf, the Sultan of Wadai, as suzerain, was preparing to advance in support of his vassal, Rabih deemed it prudent to retire from the borders of Wadai and direct his efforts against Baghirmi.

The determining motive of Rabih at this time was probably the need of obtaining arms and ammunition. It is necessary, therefore, to know the chief lines of communication with the commercial highways of the world. When he was in occupation of Dar Fertit and Dar Banda there were three main caravan highways leading to the north. The first passed through Khartum, but the Mahdi and the Khalifa had confiscated his ivory and slaves, and seized his arms and ammunition. The two other highways led through Dar Runga and Wadai to Benghazi and Tripoli, and through Bornu (Kuka), Bilma, and the Fezzan to Tripoli. Rabih had been refused facilities to make use of either of these commercial highways. He had especially requested the Sultan of Baghirmi to permit him to pass through his territory to Kuka, and when refused he had sworn to revenge himself.

The Sultan of Baghirmi at this time was Muhammad Abd-er-Rahman Gaurang, son of the Sultan Abd-el-Kadir, who reigned at the time of Barth's visit. When Rabih's invasion was imminent Gaurang appealed for assistance to the Sultan of Bornu at Kuka, and sent his son, who arrived at Kuka during Monteil's visit (April to August) in 1892. The Sultan of Bornu refused alliance and help. The Sultan of Baghirmi retired to Mainfa on the Shari, which town he fortified. Here he held out against the attacks of Rabih for some five months, when, pressed

by hunger and despairing of help, he cut his way through the lines of the besiegers, and reached Massenya his capital. The Sultan of Wadai had sent an army to help him, but this was defeated by Rabih. Thus early in 1893 Baghirmi was added to his increasing dominions.

Thereupon Rabih passed on towards Bornu, having probably Kuka in view, and thereby hoping to open up communications with Tripoli. The chief of Belda, a petty state, between the Chad and the Binue, became his ally; on the borders of Baghirmi a party of Bornu people, who were discontented with their Sultan, invited him to invade their country. Having occupied Logon, which he made his base, he advanced towards Kuka with 2000 men, and was attacked by the Bornu general with an army of 12,000 men. The battle was fought at Jillay, between Logon and Kuka, and the army of Bornu was defeated with great loss. A second Bornu army of 50,000 men, led by the Sultan of Bornu himself, was likewise defeated between Jillay and Kuka. The Sultan of Bornu retired to his capital, Kuka, from which he fled when summoned to fight by Rabih, who had speedily followed. Thus in December 1893 Kuka fell into the hands of Rabih.

The Sultan of Bornu had fled to Zinder, in the vicinity of which he was again defeated by Rabih. Two nephews of the Sultan assumed the offensive and attacked Rabih again and again. One of them retook Kuka, and Rabih, unable to make Kuka his capital, took up his residence at Dikwa (or Dikoa) near the south shore of Lake Chad, and some eighty miles from Kuka. In order to secure his retreat to the south-east he established garrisons at Gulfei on the Shari river, and at Kussuri and Logon on the Logon river.

It was feared in Great Britain that Rabih might proceed against Kano, and negotiations were opened with him in 1894, and it is believed that the commercial capital of the Central Sudan was thus indirectly saved from the fate of Kuka. In 1898 the Sultan of Turkey sent a mission to Rabih, who, it is said, acknowledged the suzerainty of the Sultan. Meanwhile, in 1896, Rabih suffered severe losses in a battle with the men of Zinder. He then attacked and defeated the Sultan of Mandara between Lake Chad and the Binue, but was himself twice defeated down to 1899. These defeats dealt severe blows to his prestige.

In connection with the French, the chief thing to note is that Rabih was in the direction of Sokoto when M. Gentil made his descent of the Shari and arrived in the *Leon Blot* at the Chad on November 1, 1897. On that occasion the garrisons of Rabih at Kussuri, and Logon and Gulfei retired to Dikwa, terrorised, it is said in France, by the arrival of the brothers of Crampel. These garrisons, however, soon reoccupied their posts. Rabih himself appeared on the scene to defend the southern borders of his territory. As the people of Gulfei had welcomed the arrival of M. Gentil, whom they regarded as a liberator, Rabih visited them with severe reprisals.

When M. Gentil left Massenya, the capital of Baghirmi, in November 1897, he had concluded a treaty of protectorate with Gaurang, and M. Prins was left with him as French Resident. Soon, however, Rabih

invaded Baghirmi, drove Gaurang from Massenya, which he burnt, and devastated the country. Thereupon the Sultan of Baghirmi retired up the Shari on the support of the French posts.

Rabih has been described as tall and spare, of simple tastes, and about sixty-five or seventy years of age. A man of commanding ability and military skill, he had collected an army of 8000 to 10,000. Horses were used for mobility, the riders fighting on foot. He was said to have about 400 rifles, and had been importing them from Tripoli.[1]

The Joalland-Meynier Mission.[2]

After the collapse of the Voulet-Chanoine Mission in July 1899, the command devolved on Lieutenant Pallier, but in September he decided that the original plan of the Expedition was no longer feasible, that it was not possible to continue the march to the east, and he therefore returned by the Western Sudan route. Lieutenant Joalland, who had been promoted Captain on the 2nd of June 1899, then assumed command of the Mission, supported by Lieutenant Meynier. A despatch of 7th July 1899 had instructed Colonel Klobb that the junction with the Foureau-Lamy Mission was not the principal objective, but that national interests made it necessary to arrive as soon as possible at Lake Chad. Captain Joalland therefore regarded it as his duty to resume the march to the east. As he had learned that there were 100 km. of waterless tract between Zinder and the Chad, and full moon was on the 18th of October, he decided to time his departure for the first days of October.

On the 3rd of October the new mission left Zinder, and arrived on the 10th inst. at Gouré. There he received the news that Commandant Lamy had reached Agadez. Between Gouré and Kakara there are some important villages. He arrived at Kakara, the last village before the Chad, on the 17th of October. About 65 km. from that point are found the wells of Mihr, beyond which there is a long tract without water some 100 to 150 km. according to the route followed. On the 19th he arrived at Mihr, and at Wudi after 38 hours, having covered in that time 125 km., and 525 km. in 21 days. On the 23rd he arrived at Nguigmi, where he rested till the 2nd of November. There he concluded a treaty with the Sultan, giving to France the west shore of the Chad from Barruwa to Nguigmi, and the north shore up to Kanem. The whole country between Nguigmi and Ngouri is wholly deserted. Formerly it was inhabited, but it has been completely abandoned since the arrival of the Ouled Sliman (Aulad Sulaiman), the inhabitants having all retired towards the Chad and the south of Kanem. On the 8th of November he arrived at Rig-Rig, after having

[1] For an account of Rabih, see Birkbeck Hill's *Colonel Gordon in Central Africa*: Gessi's *Seven Years in the Soudan*: Slatin's *Fire and Sword in the Sudan*: and the *Asiatic Quarterly Review*, January 1901.

[2] "De Zinder au Tchad et conquête du Kanem." Par le Capitaine P. Joalland, chef de la Mission Afrique Centrale.—*La Géographie*, 15 May 1901.

crossed the arid tracts north of the Chad. Rig-Rig, which is east of Kiskaoua, is the centre of a group of villages occupied principally by the Tubu. All had been evacuated, but on more than one occasion a reconnaissance was suddenly attacked.

At the time of M. Joalland's arrival Kanem was in a state of anarchy. The following is an account of the ethnography. The Ouled Sliman (Aulad Sulaiman) occupy the north of the Chad and Chittati. They are divided into two sections. The one, which is much the more important, is composed mostly of Arabs, and has for chief Sheikh Raouss (Raus). The chief of the other is Sheikh F'Dinn, who separated from the former some seven years ago in opposing Sheikh Ahmed, the younger brother of Sheikh Raus, as chief of the Aulad Sulaiman. These two sections are at war, and the Sheikh F'Dinn, although he has but a few Arabs, is able to sustain the contest from the support of the Tubu. The Aulad Sulaiman do not cultivate the soil. They are exclusively occupied with the breeding of cattle, sheep, and camels, but they are chiefly raiders, and it is to them that the ruin of Kanem is ascribed. As soon as Kanem is occupied by France it is highly probable that the Aulad Sulaiman will soon make their submission. M. Joalland entered into relations with Sheikh Raus, who was friendly. While Sheikh F'Dinn, chased by his enemy, was obliged to make his submission to Commandant Lamy when he passed through Barroua (Barruwa).

The negroes of Kanem are, according to M. Joalland, the only interesting people in the whole of Kanem proper. From the south of Chittati up to the Bahr-el-Ghazal, and from the Chad up to the great desert zone which separates Ouadai (Wadai) from Kanem there is a country rich in grain, dates, and cattle, which promises to become a splendid colony, as soon as peace and unity are secured, to judge from the riches which it produces, notwithstanding the state of anarchy and chronic strife. The whole land has been placed nominally by Ouadai under the authority of Halifa Djerab, a descendant of the ancient chiefs of the country, son of Halifa Moussa and of an aunt of the actual [late] Sultan of Ouadai. But this unity of command was a mere name. Actually Halifa Djerab had formerly his residence at Mao; but on account of discord between him and Sheikh Raouss he now resides at Débénenki, whilst Sheikh Raouss took under his protection Halifa Agui, a cousin-german of Djerab, who had declared himself chief of Kanem. Ouadai has never intervened, content with pressing now the one and then the other. There only remained to Halifa Djerab the cantons of Débénenki, N'Gouri, and Moudo. Only the first obeys him; the others consider him as their chief, but take care not to mind him. When Halifa Djerab quitted Mao many of the inhabitants of Gala and of Mao followed him to Débénenki; others took refuge in Dékéna, and received from the chief of that country great tracts of land in the fertile valley of the Bahr-el-Ghazal, but obliged to obey both Halifa and the chief of Dékéna, they in fact obey nobody. Thus at the time of M. Joalland's visit there were as many authorities as there were cantons, and between them there was often rivalry that led occasionally to war.

The Tubu (Tebbous), that is the people of Tu or Tibesti, are found

throughout the lands which extend from Gouré up to Darfur, and from the Chad to the Fezzan by way of Tibesti. They are nomads all of them for the most part. Independence is their characteristic. They wander anywhere, and pay a slight rent or tax in the land where they find themselves. Sometimes they establish a village, but there is no cohesion among them. They are met with everywhere, but without any chief. They may be compared to the Peuhls scattered in the villages north of the Niger. Above everything they are raiders and highway robbers. Save at Rig-Rig, where several of his reconnaissances were attacked, M. Joalland did not come into contact with them.

To the south of Kanem Arabs are found. From east to west there are the Arabs of Dékéna, of Assala, the Hammadias, and the Ouled Bokhters. All these Arabs are strongly mixed with blacks. They were independent of each other, and paid tribute to Ouadai and to Rabah. To this enumeration of tribes are to be added, first, the Babalias, who are descendants of a tribe that came formerly from Medina, and dwell in the single village of Bit El-Fil: and, secondly, the inhabitants of Goulféi, chased by Rabah, who have taken refuge in Dékéna.

It was this anarchy, this absolute want of authority, that occasioned M. Joalland the greatest difficulties, such as the most troublesome difficulty of procuring provisions. No plan of campaign was possible. M. Joalland decided, however, to reconstitute an empire of Kanem, to bring all the negroes under one government. This end has now been attained.

To resume the account of M. Joalland's itinerary from the 8th of November, when he arrived at Rig-Rig, he departed from this place on the 10th, and arrived at Débénenki on the 17th, and M. Meynier, who had been sent in advance, had received on the previous evening the submission of Halifa Djerab and of the canton of Débénenki. Halifa was twenty-six years of age: he is tall, good-looking, and very intelligent. From the first day on which the advantage of the French occupation was explained to him he fully acquiesced, and became a most useful and devoted auxiliary, worthy of the greatest confidence. Ngouri is only 8 km. from Débénenki. Halifa having made his submission, it was hoped that his Viziers (*Kachellas*, or *Kashellas*) would follow suit. Couriers were sent, who brought no response. M. Joalland hardly believed he would meet with resistance, but on November 22, just when about to start with his column, he was warned by Halifa that he would be attacked on the way. In fact, at a distance of 2 km. from the village every able-bodied man in the cantons of Ngouri and of Moudo had assembled. An attempt at parley proved futile. After a combat of two hours M. Joalland entered Ngouri. This battle, which was besides the only one that he fought, gave him the whole of Kanem. The people of Ngouri had the reputation of being invincible, and they considered it would be mere play to annihilate M. Joalland and his men. Two days after the *Kachella* Bagara, the chief of Ngouri, asked to make his submission. On the 25th of November M. Joalland signed a treaty with Halifa Djerab, to whom it accorded the whole of Kanem up to Chittati, and restored the lands of Gala and of Mao.

There M. Joalland received news that whites had arrived at Goulféi. Reports were current also about a victory of the French over the troops of Rabah. It was therefore thought that the Mission of M. Gentil had made the descent of the Chari. They therefore set out on the 29th of November with 100 guns, leaving at Kouli, near Ngouri, the camels and 60 guns. On the 1st of December a treaty was signed with the people of Dékéna, and on the 4th with those of Assala. The chiefs hastened to come, happy all of them to find at last a protector against Rabah and Ouadai. M. Joalland left Assala on the 9th of December, accompanied by the son of the former chief of Goulféi. There he arrived on the 10th of December, but could find none of the whites that had been announced. On the 11th he was informed that Europeans were at Mandjafa, but this report was denied the same evening. Then he was told that Bousso was the point of concentration of the Gentil Mission. Wishing to enter into relations with this Mission he despatched a courier by pirogue with an escort of six tirailleurs, and then returned to Kanem in order to organise the rule of Halifa. At Dagana (Dékéna) he learned that the courier had been unable to pass, that he had been stopped by the army of Rabah in its flight to Dikoa. And the courier himself returned to Dagana on the 21st of November. Wishing to get into touch with the Gentil Mission, M. Joalland sent Lieutenant Meynier to seek for it, and to inform M. Gentil that M. Joalland intended to put the affairs of Kanem into order, and as soon as M. Meynier returned, to set out for Zinder, the aim of the Central Africa Mission having thereby been achieved.

On the 24th of December he set out from Dagana and returned to the camp at Kouli on the 27th; he then shifted the camp to Riguédo, north of Ngouri, and on the 3rd of January 1900 he set out with 50 guns to visit the north of Kanem. Halifa Agui had openly declared himself an enemy, but he was killed in a reconnaissance on the 4th of January. By his death the rule of Kanem was settled and all the natives recognised Halifa Djerab as chief. He terminated this reconnaissance by a circuit to the wells in the north of Kanem beyond 15° N.L. The Ouled Sliman had fled before him, all of them protesting their devotion. He could have overtaken them, but he preferred to let time do its own work. Just as the Touareg after the taking of Tombouctou had been induced little by little to make their submission, so will it be with the Ouled Sliman. Now that Kanem is occupied, which feeds them, they will come after a while to accept the authority of France.

The Mission was therefore terminated. While waiting for the return of M. Meynier, Captain Joalland made a tour through the Arab countries in the south. On the 30th of January he received news of his comrade and of the Gentil Mission, on behalf of which he was requested by Captain Robillot to remain and render assistance. On the 3rd of February, therefore, he left Kanem, and after a rapid march of five days he arrived at Goulféi on the 8th, and thither M. Meynier came the same day after covering 700 km. in fifteen days. The French flag was flying from Ngouri to Goulféi; the north of the Chad, Kanem, and the Bahr-el-Ghazal had all given the French troops a good reception. Much of this success was due to the method and policy of M. Joalland

and his associates. Unlike Voulet they made it their aim to avoid "blood and iron," to behave well to the natives, and to conciliate them.

Goulféi was occupied by 300 to 400 guns. Captain Joalland pitched his camp on the right bank of the Chari, and sent each day reconnaissances on the left bank, deeming the offensive to be the best method of defence. Some days after his arrival at Goulféi on the 8th of February a courier came from the Saharan Mission announcing their arrival on the Chad. Captain Joalland therefore left M. Meynier in command, and set out to meet his fellow-countrymen. On the 18th of February he met the Saharan Mission near Débénenki, and on the 24th, at Goulféi, he placed his Mission under the orders of Commandant Lamy. From that date to the 24th of May he was occupied in the vicinity of Koussri in the campaign against Rabah, against whom he and his associates played an important part. On the 24th of May Captain Joalland set out for Zinder, and passed through Bornu. From Dikoa his itinerary led him through Maiduguri and Magoumneri, whence he proceeded north, crossing the Komadugu Yobe near Doutchi (Duchi), and on the 10th of July arrived at Zinder, where they met with a grand reception. On arriving at Zinder he was delighted to find the country in a settled and satisfactory condition, and that the pacification was complete. On the 19th of July, however, a reconnaissance was made with 100 guns to Tanamari, 110 km. north-east of Zinder, where Moussa (Musa), a renowned Touareg chief, was attacked, who had been the terror of the whole of Damerghou. While waiting to be relieved, to be permitted to return, M. Joalland made a tour through the territory of Zinder, and prepared an almost complete map. On the 11th of October he and his associates set out on the Sudan route, and on the 24th of December 1900 he left Say to return to France through Dahomey.

M. Joalland gives a short account of Zinder and its organisation, which may be here summarised. Three distinct races occupy the country. The dominant race is the Haoussa (Hausa), to which the Sultan and his family belong. Formerly the country of Zinder was a tributary province of the empire of Bornu. It follows, therefore, that numbers of Bornu people are found among the Hausa, and these had greatly increased since the invasion of Bornu by Rabah. The third race is the Touareg (Tawarik).

The political organisation of Zinder is feudal. The head of the empire is the Sultan. It is impossible to describe the adoration of which this chief is the object on the part of his subjects. His desires are orders immediately executed. His authority is such that he said one day, "Nothing happens in this land which I don't know immediately, and nothing can be lost which is not reported to me." He is surrounded by his Viziers, each of whom has his well-defined department. One, the *Caïzamma*, is the chief of the armies; the *Serky Foulani* is the prefect of the town and master of all the strangers; the *Serky N'Rouafi* has charge of all the waters of the country; *Serky N'Boyi* is the head of the Sultan's household. There are many others. At Zinder besides these there are found the chiefs of all the provinces. The whole country is divided into

cantons; at the head of each of these is a *Serkŋ*, who is a native of the canton, and is always taken from the same family. This organisation has been retained, as Captain Joalland quickly discerned that to command the Sultan was to command the country. Zinder is a land where corn, citrons, millet, maize, rice, and dates, and all the products of the Sudan are abundant. The climate is healthy, and M. Joalland believes that the country has a great future. He adds a few words on the Touareg Kéloui, who live in Zinder, Damerghou, and Air. He believes that they will make their submission in good time, induced thereto by the establishment of the French post at Zinder, by the firm but friendly administration, by the death of Moussa, who was killed at Tanamari, and had been their inveterate enemy, and lastly, above all, by the need of obtaining supplies from Zinder.

The Bretonnet-Gentil Mission.[1]

The Bretonnet-Gentil or Gentil Mission had for its aim to work up to the Chad from the Congo. M. Bretonnet, the second in command, had left in September 1898, but alarming news were soon received from the Haut Chari (Upper Shari). Rabah had swooped down on the towns of Koussri or Koussouri, Goulféi and Chaoui, and imposed on them a heavy tribute for not having offered opposition to M. Gentil and the passage of his steamer to the Chad in 1897. Sultan Gaurang had burned his capital and retired to Kouno, some 500 km. in the rear. There he was rejoined by the French Resident, M. Prins, in April 1898.

Efforts were speedily made to concentrate troops and put them at the disposal of M. Bretonnet, who received orders to support Sultan Gaurang. Thereupon the Minister of the Colonies drew up a more complete programme for M. Gentil, who was appointed Commissaire du Gouvernement au Chari with full powers, civil and military, including the other Missions when they should arrive within his territory.

M. Gentil left France on the 25th February 1899, and on the 30th of March he rejoined Captain Robillot, who had preceded him by a month. At Brazzaville he remained till May. In the first days of June he received an account of affairs from M. Prins, who was returning to France. M. Bretonnet had left the station of Gribingui in May, and M. de Behagle was a prisoner of Rabah. M. Gentil arrived at Gribingui on the 29th of June 1899, and reached the Chari on the 16th of August at a place called Gaoura, on its left bank. There they received the news of the sad fate of M. Bretonnet. At Togbao on the 19th of July he had been attacked by Rabah, who had 12,000 men, 2700 of whom were armed with guns. M. Bretonnet, who was deserted by the Sultan of Baguirmi, had only 51 guns. The seven Europeans and forty-four Senegalese maintained their ground for six hours, till the last man fell. Of the little band only three escaped death, but each of them was

[1] "Occupation et Organisation des Territoires du Tchad." Par M. Gentil.—*La Géographie*, 15 May 1901.

wounded. One of them, a native sergeant, succeeded in escaping from the hands of Rabah and bringing the report of the battle. Sultan Gaurang had retired in the direction of Goundi.

The month of September was passed in the work of concentration. Rabah was strongly entrenched at Kouno, and was preparing to attack and to effect a junction with Senoussi, the Sultan of Dar Rounga, whose daughter had been married to one of Rabah's sons. Captain Robillot had 143 guns and two small pieces of 65 millimetres, and by the 9th of September this force was increased to 271 guns. It was unwise to reduce the garrison of Gribingui as Senoussi might attack the French in flank and rear. M. Gentil decided, however, when some expected troops did not arrive, to leave only 65 guns at Gribingui. He set out on the 12th of October and reached on the 17th Fort Archambault.

M. Gentil decided not to await Rabah's attack, and ordered the march on Kouno. The force amounted to 344 guns and 4 cannons, under the command of Captain Robillot. M. Gentil took charge of the flotilla with the reserve of ammunition. There were no auxiliaries. The battle began on the morning of the 29th of October, and lasted till evening. About mid-day, the enemy, beaten in the open field, began to flee. The village was taken by assault, but Rabah and his guard had taken refuge in a central *tata*, where they maintained their ground. M. Gentil's aim had, however, been attained, and his camp was now secure from attack. The force returned to Fort Archambault. The losses had been severe on both sides. The French had 46 killed and 106 wounded. Shortly after it was found when the *Léon Blot* made a second descent of the Chari that Kouno was completely evacuated. On the 8th of November Rabah fell back on the Logone. Sultan Gaurang had rallied his people and rejoined the French at Fort Archambault, and natives supplied provisions in abundance.

In the beginning of the year M. Gentil heard news of Captain Joalland. On the 14th January Captain Joalland with 174 guns was posted opposite Goulféi, the Mission of the Chari was at Fort Archambault, and Rabah was between the Logone and Dikoa. The arrival of the Sahara Mission had been announced from Zinder, and it united with the Central Africa Mission at Débénenki on the 18th of February. The joint Missions then came under the command of M. Lamy. On arriving at Goulféi on the 24th February, they found that Fadl Allah, the son of Rabah, had been skirmishing with Lieutenant Meynier who was encamped opposite him on the right bank. On the 17th a native sergeant with 40 men had taken Marra, a small place which was defended by 150 guns of Rabah. Commandant Lamy decided to leave Goulféi and pass on to Koussri which was less strongly defended, and was taken on the 5th of March. Fadl Allah then moved out of Goulféi, and pitched his camp some 5 km. from Koussri. He was put to flight on the 9th of March.

During this time M. Gentil was at Fort Archambault, but set out on the 13th of March to join Captain Joalland. On the way he received news of the Sahara Mission through Captain Lamothe, who was posted on the Bahr Erguieg. Then a report was received that Rabah had departed

from Dikoa and seemed to be advancing on Koussri. On the 14th of April M. Gentil met M. Foureau at Mainchaffa. Seven days later he arrived at Koussri.

Rabah was posted 6 km. from Koussri. In concert with Commandant Lamy, who assumed command of the troops of all three missions, it was decided to attack on the morrow. The action began at ten in the morning of the 22nd of April, and was terminated by ten minutes past twelve. The Saharan troops, commanded by Captain Reibell, received orders to execute a turning movement on the left; the Central Africa Mission sustained the attack of the enemy during almost an hour. The Chari troops, commanded by Captain Robillot, were held in reserve till the turning movement had been effected, and then led to the attack by the Commandant Lamy. The enemy could not sustain it; the *tata* was assailed and taken; and Rabah saw the day was lost, but made a supreme effort to regain the *tata*. It was in meeting this movement that Commandant Lamy was killed, but ere he expired he learned that Rabah was killed, and that he had gained a decisive victory. The Chari Mission had 10 killed or mortally wounded, and 27 wounded; the Central Africa Mission had 7 killed and 13 wounded, and the Sahara Mission 2 killed and 11 wounded. The enemy left more than 1000 dead on the field, all his standards, and the three cannons taken from Bretonnet. Many were made prisoners, and a detachment of cavalry, some 150 strong, twice overtook the enemy in their flight, and made about 8000 prisoners. Such was the end of Rabah and his empire.

M. Gentil decided on founding the post of Bousso, which he called Fort Bretonnet; that of Mainchetfa or Fort de Cointet; and that of Fort Lamy opposite Koussri or Koussouri.

M. Gentil gives some account of the organisation of these territories. The whole land is divided into two regions: the one civil, administered exclusively by civil functionaries under the direction of M. Bruel as administrator; the other military, under the command of Captain Robillot. M. Bruel has made reconnaissances of the territory in his charge. He has been able to group the natives under the command of chiefs, and is proceeding to enumerate the population. He has noted no fewer than 378 villages within a region relatively small, and has estimated the density at 7 to 10 per sq. km. The civil region comprises exclusively the heathen tribes which constitute the three principal ethnical groups: the Banda, the Mandjia, and a part of the Sara. The Banda are much the most intelligent and the best fighting men. The Mandjia are the best workers. Several reconnaissances in the civil region have ascertained the basins of the Kemo, the Nana, the Gribingui, and the Mpoko. The reconnaissance of MM. Bernard and Huot has identified the Bahr Sahara or Sara with the Ouam, the upper course of which had been traversed by M. Perdrizet. One of the affluents of the Ouam, the Fafa, which is navigable for pirogues, will probably afford a new route to the basin of the Chari. Geographically viewed, the civil region is almost entirely known. The density of population will soon be ascertained, and will be the basis of levying a tax which has been

already taken in hand. There will soon be two routes in place of the one track hitherto used, and the day is at hand when human porterage will be superseded by convoys of wagons.

The military region, which begins at the 10° N.L., comprises above all the Muslim population, although there is south of this parallel a great many pagan tribes, such as the Sara and the Gaberi. The itineraries of Captains Cointet, Lamothe, and Galland, have made these peoples fairly well known, and the geographical results of these reconnaissances will be published in a map which is in preparation.

After the battle of Koussri M. Gentil made a new voyage on the Chad with the *Léon Blot*. As the waters were still very low, he believes he may affirm without fear of being mistaken that the great lake is navigable at all seasons on condition of keeping from 3 to 5 km. from the shore. At that distance the depths are more than 3 m., increasing considerably inwards. On the east side there are many sandbanks and on the west great depths. He remained eighteen days on the Chad and explored all the arms of the delta of the Chari. But he had no time to visit the islands inhabited by the Bouddouma. Pirates and robbers, they showed little desire to enter into relations with the French. They are rich, have many cattle which they graze on shore and take off to their islands in their boats on occasion of alarm. Lieutenant Kieffer, setting out from Mainfa, descended the Chari to 10° N.L., and then ascended the Logone up to Laï. Most of the chief positions have been determined astronomically.

The French protectorate over Baguirmi was established in 1897 and has been strengthened by the intervention on behalf of the Sultan against Rabah. The Sultan of Baguirmi has been granted almost complete autonomy, but is bound to contribute towards the cost of founding and maintaining military posts. The French have received the right, however, to administer directly the delta of the Chari, which is inhabited by Arab pastoral and agricultural tribes. It is well known that the Muslim population has already its own native organisation, which is relatively superior and is a kind of feudal system.

Regarding the territories of the Chad, M. Gentil says that it is a region rich in cattle and all kinds of grain. Besides, its numerous population produces leather and stuffs, and consumes a great deal of European commodities. A market may be there developed for French goods, but it will be necessary to respect the organisation of the local trade. The commerce of these parts is wholly in the hands of Tripolitans, and there would be great danger in any attempt to supplant them. Entrepôts and other facilities may be provided, but no attempt must be made to compete with them or interfere with their transactions.

For several years past all who have followed the several enterprises of the French in their efforts to penetrate the Sudan have been kept well informed regarding them by many geographical organs of the Press. This account of the Central Africa Mission and of the Chari Mission has been derived from the communications of M. Joalland and M. Gentil on the occasion of their reception by the Geographical Society of Paris

on the 14th of May 1901. These appear in *La Géographie*, the Bulletin of the Geographical Society for the 15th of May. In this recognition we desire to acknowledge also the work of the *Bulletin du Comité de l'Afrique Française*, which, ardently political as well as geographical, has month by month been devoted to the aims and concerns of French affairs in Africa. Both societies may well be congratulated on the success which has now attended their efforts in promoting the penetration by France of the Central Sudan.

GEOGRAPHICAL NOTES.

EUROPE.

Russian Anthropology.—M. Zaborowski has made a study of the skulls collected in different parts of Russia and Siberia by M. le Baron de Baye, and he has been able in consequence to clear up several obscure points in the history of the human race. He has pronounced against the old theory that the earth was peopled from the north, and that the cradle of the race was in Siberia; he has demonstrated that the central regions were already inhabited when Siberia was still one enormous glacier. M. Zaborowski has also proved that the Finns from the north colonised Russia, though so lately and so slowly that the Caucasus is still almost entirely peopled by Turks or Mongolians.

M. Zaborowski points out that one skull which is curiously covered with red powder has the same characteristics as other very old ones found in caves at Mentone and other places, which leads one to conclude that at some far distant time one race inhabited the whole of central Europe. M. Zaborowski is inclined to think that this unknown race must have been related to the one to which the Cro-magnon skull belongs.

The Italian Emigration Law has been passed because of the frauds committed by emigration agents. Thousands of poor Italians have been shipped to all parts of the world with assurances of work and prosperity, to find themselves in foreign lands in starvation and greater misery than they had left in Italy. They have been induced to go, not for any advantage to themselves, but entirely for the benefit of unscrupulous agents. This has been felt to be a national disgrace, and the new law is designed to prevent its recurrence. It provides as central authorities an Emigration Commission, under the Minister of Foreign Affairs, and an Emigration Council; the latter is composed of the head of the Commission, representatives from the Home, Treasury, Naval, Educational, and Agricultural Departments, a geographer, a statistician and an economist, and one member chosen by the co-operative societies and another by the principal benefit societies. The Commission is in correspondence with the authorities at home, Italian consuls abroad, foreign emigration offices, and all institutions at home and abroad for the benefit of emigrants. Besides these central authorities, inspectors have been appointed at the principal Italian ports, committees chosen in the districts which furnish most emigrants, and emigration offices established abroad, where Italians may apply for advice and work. In addition, there are to be emigration inspectors travelling abroad.

The law enacts that no one may sell a ticket to an emigrant without a licence from the Commission, and that the cost of the ticket is to be approved. These licensed agents are forbidden to "incite to emigration," and they are not allowed to receive anything beyond passage money; further, the emigrant may recover his

passage money if he is prevented by illness from going. The agent has to provide food and lodging if the emigrant is delayed by quarantine or shipwreck, and to give him compensation if he is rejected at his destination. The Italian emigrant will now be safeguarded from the moment he leaves his native village until he is fairly established in his new home. Emigration is of importance to Italy as an outlet for her surplus population, and as a means of extending her influence abroad. Hitherto it has been shadowed by the miserable fate of many reckless and inexperienced Italians; but it is expected that under the influence of these new provisions it will prove an increasingly valuable element in the national life.—*Questions diplomatiques et Coloniales.*

ASIA.

The Yun-nan Railway.—On July 5th the arrangements made for the construction of this railway by M. Dourner, the Governor-General of Indo-China, were confirmed by the French Chamber. A company, with a capital of 12,500,000 francs, is to be formed within three months to float the line from Hai-phong to Lao-kay, to be made by the Indo-Chinese Government, and to construct and float the railway from Lao-kay to Yun-nan-sen. The company will receive from the colony a subsidy of 12,500,000 francs and also a guarantee of 3,000,000 francs for interest for seventy-five years. This guarantee will enable the company to issue 76,000,000 francs in bonds at 3 per cent., and will give them altogether command of 101,000,000 francs. To the Chinese frontier the line, 400 kilometres long, consists of three sections: Haï-phong to Hanoï, Hanoï to Viétri, and Viétri to Lao-kay. The first section is to be handed over to the company before 1st April 1903, and the other two before 1st April 1905. No date has been fixed for the completion of the line from Lao-kay to Yun-nan-sen.

The government has long had in view the construction of this railway, and surveys were begun some years ago, but were interrupted by the Chinese rebellion. The line from Lao-kay to Yun-nan-sen will be 468 kilometres. M. Dourner is strongly of opinion that it should be continued from Yun-nan-sen to Sion-fu on the Yang-tse-kiang, from where it would draw the produce of Central China to Tonquin.

This railway will be of great political and commercial value to France. It will be a protection to her Indo-Chinese possessions, and it will compete with our Burmese railway, which starts from Rangoon and is to run to Kun-long on the Chinese frontier, and may possibly be constructed by way of Tali-fu to Yun-nan. The sunny province of Yun-nan is a sanatorium for Tonquin. The population is mostly Mongolian, and it is not dense, so that there is an opening for European colonisation. The soil is rich and fertile, and the country has great mineral resources.—*Revue de Géographie*, August 1901.

AMERICA.

Irrigation in the United States is the subject of a recent article by Mr. Albert Perry Brigham, who contends that somewhat more than one-third of the entire territory of the United States, exclusive of Alaska, must depend on artificial watering for its agriculture. Except in a limited degree, for grazing, these lands have no value without water; with water, on the other hand, they are unsurpassed in fruitfulness. Experts believe that about one-tenth of the total body of arid land can be brought under the plough, if all the water is used to the best advantage. Thus, not land, but water, is the great problem of the West. It is said that if Colorado made the water now used supply twice the present area, the wealth of

the state would be increased by £4,000,000. Cheap and abundant food in full variety is essential to the full development of the resources of the West. From the simple point of view of taxable wealth, therefore, all Americans, both of the east and the west, have an interest in irrigation. This is the phase of the subject which is beginning to command popular and legislative attention in Washington and throughout the country. The importance also of artificial watering, in dry seasons, for fruit, hay, and other crops is now realised; 100,000 acres of sugar-land are under irrigation in Louisiana; rice fields are irrigated in the Carolinas; and irrigation is on trial in the raising of tea in South Carolina.

The study of irrigation has now been introduced into universities and technical schools, and great attention is being given by Government departments to the many problems connected with it. The Department of Agriculture deals chiefly with the equitable distribution and profitable use of water; and the Geological Survey is charged with the study of the water supply, and, since 1890, has published many reports on the progress of the Irrigation Survey. Many problems arise in connection with this work. First the selection of the soil, both as to location and quality. Probable accessibility to markets and relation to grazing lands must also be taken into account. The construction of canals involves questions of engineering. The amount of effective work to be done by a given supply of water depends on the nature of the soil, climate, proposed crop, and many other conditions. Further questions concern the modes of distribution and of application to various crops. The choice of crops raises a question of great interest, namely, the introduction to dry regions of plants which, by a long process of acclimatisation, have in other lands become adapted to arid conditions. Not only will the national wealth be enhanced by irrigation, but farming will be more thorough and exact.—*Bulletin of the American Geographical Society*, 1901.

GENERAL.

The Departure of the British Antarctic Expedition.—On August 6th, the *Discovery* sailed from Cowes on that scientific enterprise which has been advocated by British geographers for the last eight years. The following particulars of the staff and of the proposed voyage are given by the *Geographical Journal* of the current month.

"The *Discovery*, which since her arrival from Dundee had been lying in the East India Dock, cast off her moorings at 1 P.M. on Wednesday, July 31, and after being turned in the dock by the tug, proceeded down the Thames under steam, *en route* for Spithead, from which the final start was to be made. On board, in addition to the officers, scientific staff, and crew, were Sir Clements and Lady Markham, Sir George Goldie, and other representatives of the Royal Geographical Society, as well as a limited number of scientific men and others, who thus testified their interest in the undertaking, and their cordial wishes for its success. During the passage down the river the expedition received an enthusiastic send-off from the various craft in the river, as well as from groups of onlookers from the banks, who had assembled to bid a final adieu to the ship. Greetings were sent from all sides by means of signals, steam-whistles, etc., and were returned by the dipping of the blue ensign which the vessel was flying. At Greenhithe, which was reached at 3 P.M., boats were in readiness to take on shore the visitors, the *Discovery* then holding on her course with her own complement, minus one or two members of the staff who joined the ship subsequently. Sir Clements Markham remained on board and made the voyage to Spithead, where the King was to inspect the ship before the final sailing.

"On Monday, August 5, the *Discovery* proceeded at 9 A.M. from Stokes Bay to

Cowes, and at 11.30 the King came on board from the *Osborne*, accompanied by the Queen and the Princess Victoria. Their Majesties were received by Sir Clements Markham, and Mr. Longstaff and Captain Scott were presented. Sir Leopold M'Clintock and Sir Allen Young were also in attendance. Their Majesties addressed a few gracious words to Mr. Longstaff, and the King then received the officers and civilian staff, who were presented by Captain Scott. The men were inspected, and the royal party went round the upper deck and the living deck, showing great interest in all the arrangements. Before leaving the ship, the King, who was in the uniform of an admiral of the fleet, addressed the officers and men to the following effect :—

" 'Captain Scott, officers, and men of the *Discovery*,—I have had great pleasure in visiting this ship with the Queen, because of the interest I take in the Antarctic Expedition and its objects, and in order to wish you all God-speed. You are going on a service from which, I believe, great results will accrue. I have often visited ships in order to say farewell when departing on warlike service ; but you are starting on a mission of peace, and for the advance of knowledge. The results of your labours will be valuable not only to your country, but to the whole civilised world. I trust that you will be able to achieve the great work that is before you, and that you will all return safe and well.'

" Before leaving the ship, the King decorated Captain Scott with the Victorian Order ; and on shoving off, their Majesties received three hearty cheers from the officers and men of the *Discovery*. The explorers left Cowes on their adventurous voyage at noon on the 6th.

" It is unnecessary to add anything to the statements as to the programme and aims of the expedition, which have already appeared in the *Journal*. We give below a complete list of the officers, scientific staff, and crew, making up in all a complement of fifty souls. Of these four are naval officers, four (including Mr. George Murray, who goes as far as Melbourne) scientific civilians, two officers of the R.N.R., two surgeons, twenty-four naval seamen, two royal marines, and seven merchant seamen. It will be seen that the scientific staff has been completed by the appointment of Mr. Louis Bernacchi as physicist, and Mr. H. J. Ferrer as geologist. Mr. Bernacchi will proceed direct to Melbourne in September, and there join the *Discovery*, a free passage having been generously granted him by the directors of the Orient Line. His excellent work in connection with meteorology and magnetism while serving with Mr. Borchgrevink in the Antarctic are well known to our readers, while the work in the way of geological research already performed by Mr. Ferrer, a young Cambridge graduate, gives promise of valuable results from his new labours in this direction. Mr. Murray has also secured the co-operation, although but for a time, of Dr. H. R. Mill, our late librarian, who will proceed with the ship as far as Madeira, and superintend the inauguration of work in the direction of oceanographical and chemical research. It is only to be regretted that Dr. Mill's engagements have not permitted him to accompany the ship as far as Melbourne, for his acknowledged position as an authority on all matters connected with oceanography and meteorology would have guaranteed the acquisition of valuable results for science.

" The crew has been selected with much care. All, both officers and men, are young and vigorous, with the necessary reserve of good spirits to enable them to withstand the depressing influences of the Antarctic winter. Special care has been taken to supply sufficient resources in the way of recreation, and a library of about a thousand volumes has been got together, largely through the liberality of various firms of publishers.

" The programme for the voyage of the *Discovery* to the Antarctic is as follows :

After touching at Madeira, the ship will proceed to the Cape, which may be reached about September 12. In another month, or somewhat over, the vessel should arrive at Melbourne, afterwards proceeding to Lyttelton, N.Z., where the final start for the scene of operations will probably be made about the middle of December, so that the opening of the new year should see the expedition well advanced among the Antarctic ice. As has been already stated in the *Journal*, it is considered of the greatest importance that a relief ship should be ready to start, if need be, in about a year's time, for the purpose of opening communications with the expedition, and replenishing the supply of coal and other stores. Funds are still urgently needed for this object, which is one that should commend itself to all interested in the welfare of the absent explorers, and the upholding of the worthy traditions of the nation in the matter of useful enterprise. The unremitting efforts of those who remain at home are therefore still needed if ultimate success is to be attained."

LIST OF THE OFFICERS, CIVILIAN STAFF, AND SHIP'S COMPANY OF THE "DISCOVERY."

1. *Commander*—Commander Robert F. Scott, R.N., M.V.O., F.R.G.S.
2. *Second in command and navigator*—Lieut. Albert B. Armitage, R.N.R.
3. *First executive*—Lieut. Charles W. Rawson Royds, R.N., F.R.G.S.
4. *Second* „ Lieut. Michael Barne, R.N.
5. *Third* „ Lieut. Ernest Shackleton, R.N.R., F.R.G.S., F.R.A.S.
6. *Engineer*—Mr. Reginald Skelton, R.N.
7. *Surgeon*—Dr. Reginald Koettlitz.
8. *Assistant surgeon*—Dr. Edward Wilson, M.B.

Civilian Staff.

9. Mr. George Murray, D.Sc., F.R.S. (*director*), as far as Melbourne.
10. Mr. G. V. Hodgson (*biologist*).
11. Mr. Louis C. Bernacchi, F.R.G.S. (*physicist*).
12. Mr. H. T. Ferrer (*geologist*).

Warrant officers (naval).

13. Mr. E. Delbridge (*assistant engineer*).
14. Mr. T. A. Feather (*boatswain*).
15. Mr. Fredk. E. Dailey (*carpenter*).
16. Mr. Edward Else (*ship's steward*).

17. *Chief petty officer*—S. Roper (*cook*).

Petty officers (naval).

18. Edgar Evans.
19. David S. Allen.
20. William Smyth.
21. David Cross.
22. Wm. Macfarlane.
23. Thomas Kennan.

Leading stokers.

24. Arthur E. Quartly.
25. J. Whitfield.
26. W. Laskly.
27. William Page.

28. *Stoker artificer*—William Hubert.

Domestics.

29. Charles R. Ford (*wardroom steward and assistant*).
30. Charles Clarke (*cook's mate and laboratory assistant*).
31. Job Clarke (*wardroom servant*).
32. Gilbert Scott, R.M. (*marine*).
33. Arthur H. Blissitt, R.M. (*marine*).
34. Albert C. Dowsett (*domestic*).

Naval seamen.

35. William L. Heald.
36. Arthur Pilbeam.
37. James W. Dell.
38. John W. Waterman.
39. Frank Wilde.
40. Henry J. Baker.
41. William Peters.
42. J. Williamson.
43. Charles F. Bonner.
44. George B. Croucher.

Merchant seamen.

45. F. Duncan (*shipwright*).
46. H. Meller (*sailmaker*).
47. J. Walker.
48. J. Marsden.
49. J. Masterton.

50. *Dogs' attendant*—Weller.

We wish the *Discovery* and her whole company all good fortune and success in their adventurous enterprise.

Professor Otto Nordenskiold's Antarctic Expedition.—In a recent interview at Malmo with a representative of Reuter, Professor Nordenskiold made the following statement regarding the plan and object of his expedition :—

"As soon as the *Antarctic* returns from her expedition to Spitzbergen, which has been made for meridian measurements—and it is calculated that she must be on her homeward journey by 15th September—we start from Goeteborg. The time of our departure cannot, of course, be definitely fixed, for unforeseen hindrances may arise ; but we shall certainly be able to weigh anchor by about 1st October.

"From Goeteborg we shall proceed to England, and thence to Buenos Ayres and Tierra del Fuego, whence we shall make our way to the Antarctic regions. We shall endeavour to push as far south as possible with the *Antarctic*, and when winter comes on we shall send a party on shore to winter. That party will probably consist of six persons, of whom I shall be one. We shall build a small hut for ourselves, and shall engage in meteorological, magnetic and hydrographic and other scientific observations.

"As soon as we have landed, the *Antarctic* will return to Tierra del Fuego, and a scientist who will sail with her will conduct the searches in that hitherto little explored country. In that way we shall be able to work in two detachments and make as much use of our time as possible.

"As is well known, both an English and a German South Polar expedition are being sent out at the same time. In order to avoid clashing with one another, these three expeditions have come to an agreement whereby we explore the region south of the Atlantic Ocean, the Germans south of the Indian Ocean, and the British that south of the Pacific Ocean.

"Naturally we cannot advance so far towards the South as towards the North Pole, but the scientific results must be great, and we are well equipped for scientific research. I shall have some able scientists with me. Professor Ohlin of Lund, the well-known explorer, and H. K. A. Andersson will accompany me as zoologists. Dr. Bodman will come as hydrographer and magnetician, and M. Skottoberg as botanist, and Dr. E. Ekelof as medical officer. The Norwegian captain, Larsin, who has already made several voyages to South Polar regions, will be in charge of the *Antarctic*."

International Oceanic Research.—The Conference at Stockholm in June 1899, the report of which was summarised in the *Journal* for December 1899 (vol. xiv. p. 646), was to have been followed by a second Conference in the autumn of 1900,

but this did not actually come together until May of the present year. Representatives of eight nations—all of those bordering the North Sea and Baltic, with the exception of France—met at Christiania, on the invitation of the Norwegian Government, on May 6, the meetings continuing daily until May 11. The Conference was officially announced as "for the exploration of the sea," but the proceedings were conducted on the understanding that the exploration in question was to be carried out strictly with a view to practical results, especially as regards fisheries. Sweden sent six delegates, including Profs. Pettersson and Cleve, Dr. Wijkander, and Mr. Ekman; Germany sent five, including Dr. Herwig and Prof. Krümmel; Great Britain sent four, Sir Colin Scott Moncrieff, Permanent Under-Secretary for Scotland, Prof. D'Arcy Thompson of Dundee, Dr. H. R. Mill, and Mr. W. Garstang, of the Marine Biological Association at Plymouth; Denmark sent three delegates, including Captain Drechsel and Dr. Martin Knudsen; Belgium sent two; Norway two, Prof. Nansen and Dr. Hjort, to whom Profs. Mohn and G. O. Sars were added in a consultative capacity; and one delegate was sent from each of the remaining countries, Russia, Finland, and Holland, the last-named country being ably represented by Dr. P. P. C. Hoek.

The work consisted in the revision and completion of the Stockholm programme. The oceanographical section, having been very fully elaborated at Stockholm, was adopted with only a few trifling alterations and additions; but the biological programme was completely recast and brought into a form that commended itself to the conference as thoroughly practical.

The most interesting feature, from the geographical point of view, is the suggested alteration of the proposed "spheres" of the different nationalities engaged on the joint work. Instead of the somewhat patchy areas allocated to the participating nations in the map published in 1899, it is now proposed that in the North Sea south of 58° N., the whole area west of 2° E. shall be allocated to Great Britain, while to the east Belgium, Holland, Germany, and Denmark will be responsible for the sea lying off their own shores.

From 58° to 62° N. the investigation of the North Sea and North Atlantic will be shared by Great Britain, Norway, and Denmark, while the North Atlantic farther north and the Arctic Sea will be investigated by Norway and Russia. The Skagerrak and Kattegat are assigned to Norway, Sweden and Denmark; the western Baltic to Germany, Sweden and Denmark; the southern part of the eastern Baltic to Germany: and the northern part, including the gulfs of Finland and Bothnia, to Sweden, Russia and Finland. These divisions are intended to ensure that each nation will be responsible for certain definite areas, and that none shall be left out, but it is distinctly stated that "the suggested boundaries are not intended to hinder any nation from extending its researches beyond the special areas agreed upon."

The new programme for biological work is divided into three sections, dealing respectively with the Biology of Food-fishes, Plankton and Bottom Fauna, and Fishery Statistics. Under each head there are numerous paragraphs specifying the minimum requirements of the international scheme and the optional extensions which are desirable to be made if circumstances permit. In every case it is urged that the distribution of fish, fish-food, deposits, etc., should be ascertained with sufficient detail to permit of charts being drawn.

In order that the programme may be of service, there must be a proper organisation for directing the work and funds, as well as ships for carrying it on. It is understood that the participating nations, by the fact of their participation, agree to contribute the funds required for administration, and several of the countries—especially Norway, Russia, and Germany—have had special vessels built

for carrying on their share of the researches. The other nations will, it is hoped, also arrange for an adequate equipment with which to carry on their share of the work, which, although scientific in plan, is purely practical in aim.

The Conference recommends that the participating nations should appoint an International Council consisting of two representatives of each country with full powers, that this Council should meet as soon as possible at Copenhagen and proceed to appoint the *personnel* of the Central Bureau, which shall carry out the arrangements for international co-operation, and of the International Laboratory. Both the Bureau and the Laboratory shall be permanently under the control of the International Council, but it is suggested that they should be independent of each other, and the proposals of the Conference are even compatible with the two being in different countries. A statement made in the Norwegian and German press that the Central Bureau will be situated in Copenhagen, with Dr. P. P. C. Hoek as secretary, and the International Laboratory at Christiania, with Dr. Nansen as director, is obviously premature, since the appointment of the staff can only be made by the International Council, which has not yet met. The official report of the recent Conference affords no confirmation of these rumours.

The work of the Central Bureau will be mainly administrative and editorial; a considerable part of its duties will consist in the elaboration of statistics. The International Laboratory, on the other hand, will be concerned with the supply of uniform, tested apparatus to all the participating vessels, research into methods of working, and the instruction of the assistants who will carry out the work on board the different ships, the analysis of samples of water collected on the expeditions, and the supply of apparatus to the participating states at cost price.

The Conference passed a resolution stating that it considered that the provision of a steamer specially constructed for scientific fishery researches by each of the countries concerned was absolutely indispensable. It also pointed out that it was very desirable that the Central Bureau should commence operations at latest by the beginning of 1902, and that the first of the quarterly simultaneous international cruises should take place not later than May 1902.

The last of the resolutions runs as follows :—

"In distant areas of the sea, as for example the Moray Firth, in which any government has undertaken scientific experiments in the interest of the fisheries, and in which the success of the experiments is being hindered by the operations of trawlers, it is to be desired that measures be adopted for the removal of such hindrances."

This points to a difficulty arising from a curious anomaly in the political geography of the sea. Every nation has full power over all ships sailing or fishing under its flag, wherever they may be, and it can also enforce police regulations with regard to vessels of any nationality within the three-mile limit from shore which bounds territorial waters, but not a yard beyond. For many years British trawlers have been excluded from the Moray Firth in order to see whether by so doing the fish-supply, which had been rapidly declining, would revive; but as a great part of the forbidden area is more than three miles from land, it has become a happy hunting-ground for trawlers under foreign flags, and of course it is impossible to test the value of prohibiting trawling in such conditions. The guarded expression of sympathy with the difficulties arising from this state of matters will, we may hope, facilitate international arrangements for obviating the trouble which now frequently occurs, not only in the Moray Firth, but in other waters where it may be British vessels are sometimes tempted in their turn to cross boundaries forbidden to the native fishing fleets.—*Geographical Journal*, July 1901.

Ordnance Survey of Scotland. The following publications were issued from the 1st to the 30th June 1901 :—Parish Maps Scale 1 : 2500, Revised, with Houses ruled, and with Areas. Price 3s. each. *Aberdeenshire.*—Sheets XV. 13 ; XIX. 6, 7, 10, 12, 14, 15, 16 ; XX. 9, 13 ; XXIII. 1 ; XXVI. 10 ; XXIX. 1. *Forfarshire.*—Sheet XLIX. 2. *Perthshire.*—Sheets LXII. 16 ; LXIII. 15, 16 ; LXXIII. 4, 8, 12 ; LXXV. 7, 9, 10, 11, 13 ; LXXXV. 4, 8 ; LXXXVII. 1, 9 ; XCVII. 3, 12 ; XCVIII. 1, 2, 4, 6, 8, 10, 11, 13, 14, 16 ; XCIX. 2, 3, 6, 7, 14 ; CIX. 7 ; CX. 3, 8, 10 ; CXI. 1, 2 ; CXIX. 4 ; CXXa. 1. *Zetland.*—Sheets IV. 15 ; XXIV. 4 ; XXXVII. 6, 9 ; XXXVIII. 1, 2, 4, 5 ; XXXIX. 1 ; XLI. 6 ; XLII. 6, 12, 15 ; XLIII. 10, 14 ; XLIV. 9, 13 ; XLVI. 1, 5, 15.

Four Mile Maps of Scotland by Sheets, with water printed in colour.—Sheets 1, 2, 3, 4, 5, 6, (Price 1s. each).

Miscellaneous Maps.—Roman Camp, Parish of Gelligaer, County of Glamorgan (Scale 1 : 500, Price 2s. 6d.).

Six-inch Maps Quarter Sheets Revised. *Perthshire.*—6 NW., 6 NE. ; 112 NW. (Price 1s. each. With contours : *Aberdeenshire.*—43 SE. ; 74 SW. ; 84 NE. ; 85 NW. ; 93 NE. ; Price 1s. each. *Clackmannanshire.*—126 NE. ; 127 NW ; 133 SW. ; 134 NW., 134 SE. ; 140 SW. (Price 1s. each). *Perthshire.*—53 SW. ; 62 NE. ; 63 NW. ; 84 NW. ; 95 SW. ; 107 NE., 107 SW., 107 SE. ; 108 NW., 108 SW. ; 117 SW., 117 SE. ; 118 SW. ; 126 NE. ; 127 NW. ; 134 SE. ; (Price 1s. each).

The Zincographs of the undernamed Ordnance Survey Plans having, in many cases, been sold out, another edition has been printed, and is now ready for sale. All plans hitherto published in Sections are filled in complete to their margins or to the County Boundary. No revision of the original plans having taken place, these impressions are similar to those already issued to the public, except as stated above, or as notified in the column of remarks. Scale 1 : 2500, *Ross-shire.*—XLI. 15 ; XCIX. 7, with areas added ; but the old edition will be sold out. General remarks, June 1901. Scale 1 : 2500, *Ross-shire.*—Logie Easter, and Tain, XLI. 15 ; Urray, Killearnan, and Urquhart and Logie Wester, XCIX. 7 ; with areas added ; coloured ; price now altered to 3s.

Catalogue of the Ordnance Survey Publications of Scotland, revised and corrected to the 1st January 1901.

NEW BOOKS.

Vers Fachoda. Par CHARLES MICHEL. Paris : Plon-Nourrit et Cie., 1900. Pp. 560.

"At the close of 1896, when it was proposed to send an expedition, by way of Abyssinia, to meet Marchand, M. Hanotaux, Foreign Minister of France, intrusted M. Lagarde, Governor of the Protectorate of the Somali Coast, with an Embassy to the Emperor of Ethiopia." The British expedition under Rennell-Rodd being also announced, it was deemed important for the French to reach the Emperor Menilek first : and as M. Lagarde was detained at Harrar, another expedition, under M. Bonvalot and the Marquis de Bonchamps, was despatched to Abyssinia with instructions to proceed to the White Nile. M. Michel was attached to the latter, and complains that only 55,000 francs (£2200) were granted for the expenses of an expedition which was to be nearly two years absent, and to pass through a dangerous and unexplored country.

Their first stage was from the port of Obock to Djibouti and Gildessa ; their next to Harrar, where they were presented to the Governor Ras Maconen, a remarkably capable man, who may possibly succeed his relative Menilek as

Emperor, otherwise, the author thinks, Abyssinia will fall a prey to "dismemberment, anarchy, and civil war."

Owing apparently to "une incompatibilité d'humeur, une rivalité trop vive" between MM. Lagarde and Bonvalot, the latter returned to France to "fetch gunboats to place on the Nile"! and the Marquis de Bonchamps, the author, and a party with Abyssinian guards struck Nilewards from the capital Addis Abbaba, M. de Bonchamps afterwards writing to the Emperor Menilek that he hoped, "with the aid of his Majesty's troops and the assistance of Providence, to be able to establish Abyssinia on the Nile." This ambitious project was, however, doomed to failure, for the Abyssinian troops fell ill, and the party's victuals became exhausted; so, when only 150 kilomètres from Fashoda, the expedition had to return.

Two of their companions, however, MM. Potter and Faivre, pluckily achieved the voyage, some months later, from Goré to the White Nile, and reached the latter on 22nd June 1898, when again the Abyssinians all became ill, victuals failed, and they had to return. On their return journey the gallant M. Potter fell mortally pierced by an assegai thrown by a concealed native.

M. Michel's book is well written, well printed, and well illustrated, and is accompanied by a good map of Abyssinia, by J. Hansen, showing the various routes described; but its title *Vers Fachoda* is only a "catch title," as Fashoda was never reached, and its souvenir only recalls to Frenchmen a spot where, as M. Michel says, their "politique extérieure a subi un échec douloureux." The book is interesting as showing the immense desire of certain Frenchmen to secure Franco-Abyssinian influence on the Nile: and we may suggest that the somewhat mysterious breakdown of the Abyssinian soldiers on both expeditions may really have been caused by the Emperor's known disinclination to annex Nile territory.

Le Transsaharien et la Pénétration Française en Afrique. Par Maurice Honoré, Docteur en droit, Avocat à la Cour d'Appel de Paris. Accompagné d'une Carte. Paris: A. Pedone, 1901. Pp. 144.

M. Honoré's monograph gives a succinct and judicious account of his subject. After an introduction on La France Africaine, he discusses the idea of the Trans-Saharan from René Caillé to Duponchel, and from the latter to our own days. In his second chapter he gives a political study of the Sahara, and in the third an economic study thereof, which is excellent both in regard to the Trans-Saharan commerce as it is, and to the several estimates that have been framed as to the future. In the fourth chapter he discusses the many schemes and routes that have been proposed for a Trans-Saharan railway. In his concluding chapter he devotes himself to a judicial summing-up, which is judicious in its reserve. There is a good bibliography of works on the Trans-Saharan and of books, etc., which he has himself made use of. The map, however, is rather sketchy.

Outlines of Physiography: An Introduction to the Study of the Earth. By A. J. Herbertson, Ph.D. London: Edward Arnold, 1901. Pp. 312. *Price* 4*s.* 6*d.*

"Physiography" is a somewhat indefinite term, and the secondary title gives a better description of the contents of this work. The earth is described as a member of the solar system, and the changes of the seasons, varying length of the day, and of the quantities of heat received from the sun, which are due to the earth's movements, are clearly set forth. Then follow chapters on the atmosphere and its circulation, the ocean, its tides and circulation; and, lastly, a very satis-

factory exposition of the modelling of the solid crust by internal and external forces, with a short account of life on the surface. The author, from long experience in Edinburgh and at the Oxford School of Geography, knows thoroughly what is required in a text-book, and has written one which will be useful both to teachers and pupils. Not entering into minute details or disputed questions, he has dealt generally with the processes which have given the earth its present aspect, and are still modifying its surface, and has included nothing in his pages which should not be taught in schools, if geography be treated as a science.

A slight alteration in the wording might, perhaps, be suggested in one or two places, but the clearness of the exposition leaves little to be desired. The diagrams and illustrations have been carefully selected.

Russian Life in Town and Country. By Francis H. Palmer. London: George Newnes, Limited. Pp. xii + 272, with 15 Illustrations.

This volume, one of Newnes's "Our Neighbours" series, will constitute a readable introduction to those who may be desirous of forming some acquaintance with the life and customs of the subjects of the Great White Tsar. It is usually well-informed, but the writer is not always to be followed in his conclusions, which are often too sweeping, and reached without any recognition of the existence of enormous differences between North and South Russia. In much the same way little local peculiarities are treated as if they were characteristic of the whole country, and the writer is hampered by a somewhat bald style which prevents his reader from ever feeling (with the possible exception of the chapter on religious thought and ritual) the throb of Russian life in his pages. The illustrations lack both in selection and execution.

Through Siberia. By J. Stadling. Edited by F. H. H. Guillemard, M.A., M.D. (Cantab.) London: Archibald Constable and Co., Limited. Pp. x + 315, with 47 Illustrations and 2 Maps.

Mr. Stadling, the friend and last well-wisher of Andrée before he set out on his ill-starred escapade, travelled during 1898 across part of the northern tundra zone of Siberia, in order to find out if any information could be obtained from the wandering Tunguses about the fate of the aeronaut. In this volume he gives us the narrative of his journey as he pursued it from Petersburg to Irkutsk, thence down the Lena by Yakutsk to the delta of the river, where he was ice-bound on an island, and so across the tundra and the Taimir Peninsula to the Yenisei, whose course he followed in a southerly direction till he reached Yeniseisk and Krasnoyarsk, and so came into touch with civilisation again. The results of the expedition were negative so far as its prime object was concerned, but Mr. Stadling collected a great deal of valuable information about the regions traversed. The book is the work of a modest, sympathetic writer with a seeing eye, and is full of pen portraits that are true to the life in the veriest detail. His description (pp. 38-43) of the subduing effect of the taiga (virgin forest) on the sociable, cheery Russian immigrant is a brilliant study in the effects of environment. His pictures of life on the Trans-Siberian railway, even to the necessity of hiring some one to watch your baggage when you leave the compartment temporarily at a station, are remarkably vivid. He sees clearly, on the one hand, how it will not pay to transport cereal products by the railroad over a distance of 2000 miles, so that the river systems must needs be more developed, and, on the other, that many of the villages whose inhabitants hitherto supported themselves as carriers on the post-road will be ruined by the advent of the railway, since many of them are situated

in places quite unsuitable for agriculture. Still one cannot help feeling that in his pages on the future of the country Mr. Stadling is unnecessarily pessimistic.

The most original pages, however, are those that deal with the native peoples. His account of the Tunguses, Buryats, and Yakutes, which is correctly prefaced with the statement that the latter two peoples alone of the native tribes are increasing in numbers, is clear and interesting. The former are a brave and more or less practically independent people, and not more of their number are Russianised than are there Russians Buriatised who have to live amongst them as police officers and other functionaries. The country of the Yakutes is a province which in itself is as large as European Russia less Finland and Poland. It probably has the greatest range of temperature in the world, + 103 to − 93 Fahr. The lakes and small rivers begin to freeze in September. "The Yakute winter does not rage and roar as does that of Northern Europe, but suppresses all motion. . . . The constantly growing cold compresses the air more and more until it finally threatens as it were to suffocate all life beneath its weight." Against it cool currents are powerless. In two weeks, during terrible storms, the transition is made from winter to summer. The first part of the summer is dry, and the plants receive their moisture from the melting soil; later there are heavy falls of rain. The soil is said to be frozen to a depth of 1000 feet in the neighbourhood of Yakutsk. This prevents the absorption of water by the earth, hence the lack of springs and subterranean waters and the cause of numberless lakes. Under conditions such as these Mr. Stadling intrepidly held to his original plan, although detained and delayed beyond the dates when it was considered advisable to undertake it, and in his running story there is just sufficient of the statistical to give the volume value as a work of reference, and just enough of the personal to make the reader keenly interested in the traveller all the time. Except for certain slight inconsistencies in spelling that give, *e.g.* Jablonoff and Yakutsk on p. 78, and one or two slight errors, as, *e.g.* robaschka for rubaschka on p. 92, no fault can be found with a work that is pleasing in text, illustration, and cover.

The North-West Passage by Land. By Viscount Milton, M.P., and W. B. Cheadle, M.D. London, Paris, New York, and Melbourne: Cassell and Company, Limited, 1901.

The fact that a ninth edition of Viscount Milton and Dr. Cheadle's *North-West Passage by Land* has been found necessary attests its widespread popularity on both sides of the Atlantic. In this edition a postscript has been added, setting forth some features of the development of the country since 1865, when the first edition was published, and the subsequent history of some of those mentioned in the book.

America, Picturesque and Descriptive. By Joel Cook. Philadelphia: H. T. Coates and Co., 1900. 3 vols. of over 500 pages each. Many full-page Illustrations.

This is a useful work. Its purpose is not so much that of a guidebook to be used on the spot as for study before visiting the country or for reference afterwards. Thus the author gives full and excellent descriptions of the appearance of the different places, and combines these with historical narratives and accounts of the rise of local industries. The portions dealing with New York and Philadelphia (Mr. Cook's own city) are specially well done. The Americanisms employed (if we except a general tendency to superlatives) are few, and one therefore regrets the more that the author has not been superior to the common absurdity of describing the British soldiers in the Revolutionary War, Hessians

and all, under the comprehensive term "Tories." On the other hand his comments upon the indiscreet gallantry of General Fraser at the battle of Saratoga may be pondered in the present day. Great care has been expended upon the production of the volumes, and the wealth of photogravures is a prominent feature. The author has not confined himself to the United States, but includes the neighbouring parts of Canada and the Canadian Pacific route, and some of the most picturesque views are from our own dependency. The volume contains many quotations from the American poets, and we must trust that they are more accurate than the marvellous perversion of Scott (vol. i. p. 249) :—

> "Crags, knolls, and mounds in dire confusion hurled,
> The fragmentary elements of an earlier world."

But the book as a whole is carefully compiled.

"*As the Chinese see us.*" By THOMAS G. SELBY. London : T. Fisher Unwin, 1901. *Price* 6*s.*

Our national poet has sung—

> "O wad some Pow'r the giftie gie us
> To see oursels as others see us!"

In the volume now before us, Mr. Selby in a series of ten dialogues very skilfully endeavours to show us how the English appear in the eyes of the educated Chinese. The dialogues deal with a great variety of subjects, *e.g.* the ethics of Confucius, Christianity, European diplomacy in China, opium, the reform question, and the like, and certainly the Chinese side of these questions is set forth with great skill and power of argument. Obviously it would be foreign to the purpose of this magazine to discuss such controversial matters, but we can commend the book to our readers as well worthy of a careful perusal.

Manchuria. By ALEXANDER HOSIE, M.A., F.R.G.S. With Map, Diagrams, and Illustrations. London : Methuen and Co., 1901. *Price* 10*s.* 6*d.*

At a time when the Chinese province of Manchuria is attracting so much attention, the publication of this volume by the capable pen of Mr. Alexander Hosie, who lectured to us in the course of last session, is very opportune. It is not too much to say that Mr. Hosie has an experience of Manchuria which is second to none of any of our Chinese officials, and the description of the *status quo* of Manchuria which we have in the volume now before us leaves nothing to be desired. We say the *status quo*, for Mr. Hosie deliberately avoids giving us a history of the past of Manchuria, and confines himself to setting forth its present condition, its resources, and its prospects. The book is calculated to dispel many illusions and to open the eyes of the public to the actual state of affairs, both political and commercial, in this important province, which is certain to have a by no means unimportant share in the future history of the Celestial Empire. The inquirer will find in this volume the testimony of a trustworthy eyewitness as to the climate, communications, natural products, industries, trade, and forms of administration of Manchuria—matters which have not hitherto been easily accessible to the public in a compendious and manageable form. Mr. Hosie, although a member of the British Diplomatic Service, does not write with the pen of a partisan ; he sets forth clearly and plainly what has come under his own observation, and his book will be specially welcome at the present juncture in the affairs of China.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ADDRESS TO THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION, 1901.

By Hugh Robert Mill, D.Sc., LL.D., F.R.S.E., F.R.G.S.,
President of the Section.

On Research in Geographical Science.

Introductory.—The annual reassembling of friends and fellow-workers in the old revisited towns, and the annual accession of new lovers of science, furnish an unique opportunity for a survey of the advances made in each department, a fitting occasion also for remembering those who have finished their work and can aid our deliberations only by the memory of their example.

Apart from our more intimate losses in the death of many distinguished geographers and devoted workers, the period since our last meeting has been for all a year of mourning. The passing of the nineteenth century was almost like the death of a friend, and it is still difficult to realise that the century which we had been so long in the habit of associating with everything new and great and progressive has itself become part of the past. Few coincidences have been more striking than the almost simultaneous close of that unparalleled reign which gave a name to the Era including all that was best and most characteristic of the century. The death of Queen Victoria carried so keen a sense of personal loss into every heart that few attempts have been made to show how vast a portion of the stream of time—measured by progress—intervened between the terminal dates of her life. Think for a moment of the splendid advances in the one small department of geographical exploration during the late Queen's reign, the multitude of landmarks which have been crowned by the great name of Victoria—of the earth's most southerly land and its most

northerly sea, of the largest lake and most majestic waterfall of Africa, the loftiest lake of Asia, the highest peak in New Guinea, the widest desert and most populous colony in Australia, and of the two thriving seaports on either side of the North Pacific which couple together the British Dominions of western America and eastern Asia.

What could be more appropriate in this first meeting after the close of such a century and of such a reign than to pass in brief but appreciative review the advances of geography during those hundred or those sixty-five years? One thing in my opinion is more appropriate than to dwell on past triumphs or to regret past greatness, and that is to survey our present position and look ahead. In the first year of a new century and of a new reign we are reminded that we have a future to face and that the world is before us, and I propose to seize this opportunity in order to speak of the science of geography as it is now understood, and especially to urge the importance of the more systematic pursuit of geographical research henceforward.

Geography in the Universities.—The prospect of immediate expansion in many British universities seems at last likely to afford more than one opportunity of wiping out the old disgrace of the neglect of geographical science in the accredited seats of learning. Already Oxford has a well-manned School of Geography, and Cambridge has a Reader in Geography. The reconstituted University of London occupies the best position in the world for creating a chair of geographical research, situated as it is in the very centre of the comings and goings of all mankind, and in touch with the most complete geographical library and map collection in existence. The new University of Birmingham may, it is hoped, prove better than its promises, and may perhaps after all provide some more adequate treatment of geography than its proposed partition amongst the professors of half a dozen special subjects, all of them concerned in geography, it is true, but none of them individually, nor all of them collectively, capable of embodying that co-ordination of parts into an harmonious unity which gives to geography its power as a mental discipline and its value for practical application. But England in all that pertains to higher education is still a poor country, and the will to do well is hampered by the grinning demon of poverty. Here, on the other side of the Border, we are in a different atmosphere. The wave of the magician's wand in the hands of Andrew Carnegie has brought wealth that last year would have been deemed fabulous to the ancient universities in Scotland, and it will be a disgrace to our country if this splendid generosity does not result in the establishment of one or more fully endowed and completely equipped chairs of geography.

There may still be some people who view geography as the concern only of soldiers and sailors, adventurous travellers, and perhaps of elementary teachers. Exploration is undoubtedly the first duty of geographers, but it is a duty which has been well done, the nineteenth century having left us only one problem of the first magnitude. This is the exploration of the Polar regions, and even here the twentieth century clamours for new methods.

The Antarctic Expeditions.—This year has seen the long-hoped-for Antarctic expeditions set out on their great quest, a quest not only of new lands in the southern ice-world, but of scientific information regarding all the conditions of the vast unknown region. Two expeditions have been planned in Great Britain and Germany with a complete interchange of information regarding equipment and methods of work. Provision has been made for simultaneous magnetic and meteorological observations, and in some instances for the use of instruments of identical construction, and all possibility of any unseemly rivalry in striving for the childish distinction of getting farthest south has been obviated by the friendly understanding that the British ship shall explore the already fairly known Ross quadrant, where it is pretty sure that extensive and accessible land will favour exploration by sledges, while the Germans have chosen the entirely unknown area of the Enderby quadrant which no ice-protected steamer has yet attempted to penetrate, and where they enter a region of potential discovery before they cross the Antarctic circle.

The British Expedition is equipped on the good old plan that produced such fine results in the days of Cook and Ross; it is manned by sailors of the Royal Navy and is under the command of a gallant naval officer, though, unlike the earlier vessels, the *Discovery* is not herself a naval ship. As in the days of Cook the naval officers are assisted in their non-professional work by several young and promising scientific men, two of whom have already had experience of work in the Polar regions. These have the great advantage of the counsel and help of Mr. George Murray of the British Museum, who goes as far as Melbourne in the position of Director of the Scientific Staff.

No one who has seen the zeal and unflagging enthusiasm with which Sir Clements Markham has organised the expedition can hesitate to accord to him in fullest measure the credit for its successful inauguration. And no one who has seen the quiet and good-humoured determination of the commander, Captain R. F. Scott, in overcoming many irritating preliminary difficulties, can doubt his fitness to undertake the heavy responsibilities of the voyage. I at least am sure that he will be a worthy successor to Cook, Ross, Franklin, Nares, and all the other officers who have made their names and the name of the British Navy famous in Polar service. The second in command, Lieutenant Armitage, R.N.R., has had several years of Arctic experience, and among the crew there are some old whalers whose knowledge of the ways of sea-ice should prove of value. The ship and her equipment are unique; it is no exaggeration to say that she is the best-found and most comfortable vessel which has ever left our shores on a voyage of discovery.

The German Expedition has been more boldly planned than ours. It is new and experimental all through, as befits a young nation in its first exuberant efforts in a new field. If some people suppose that it may have made mistakes that our expedition has avoided; these at least are new mistakes from which new lessons are to be learned. If risks must be run—and we of the twentieth century are, I trust, no more timid of incurring risks than our predecessors of the nineteenth, or

the eighteenth, or even the seventeenth—it is good that they should be new risks. To scientific men in Germany it appears natural and reasonable that a man of science should be the head of a scientific expedition; and that a geographer should lead a geographical expedition. Many British men of science sympathise in this view. Dr. Erich von Drygalski, one of the professors of geography in the University of Berlin, has been intrusted with the command to which he was appointed before the ship was designed, and for five years he has given all his time and thought to the expedition. He is supported by a band of highly trained specialists, who have spared neither time nor travel in mastering the subjects with which they may deal, and each has also received a general training in the subjects of all his colleagues—an admirable precaution. The captain of the *Gauss*, who belongs to the Merchant Service, has taken a course of training from the Norwegian whalers off Spitzbergen. He will, of course, be absolute master of the ship and crew in all that concerns order and safety, but he will be under the direction of the leader in all that concerns the plan of the voyage and the execution of scientific work. This arrangement is one which has always seemed to me to be desirable, that the captain of a ship on scientific service should occupy a position in relation to the scientific chief similar to that of the captain of a yacht in relation to the owner; but it is subject to the drawback that a naval officer could not well be asked to accept such a divided command.

But whatever our views as to ideal organisation may be, we are all certain that both expeditions will do the utmost that they can to justify the confidence that is placed in them and to bring honour to their flags. We know that the officers and staff of the *Discovery* belong to a race which, whether trained in the university or in the navy, has acquired the habit of bringing back splendid results from any quest that is undertaken.

A Definition of Geography—The bright prospects of Antarctic exploration must not, however, blind us to the fact that exploration is not geography, nor is the reading or even the writing of text-books, nor is the making of maps, despite the recognition of leading cartographers as "Geographers to the King." These are amongst the departments of geography, but the whole is greater than its parts.

The view of the scope and content of geography which I have arrived at as the result of much work and some little reading during twenty years is substantially that held by most modern geographers. But it is right to point out that the mode of expressing it may not be accepted without amendment by any of the recognised leaders of the science, and for my own part I believe that discussion rather than acceptance is the best fate that can befall any attempt at stating scientific truth.

Put in the fewest words, my opinion is that

Geography is the science which deals with the forms of relief of the Earth's crust, and with the influence which these forms exercise on the distribution of all other phenomena.

This definition looks to the form and composition of the Earth's crust itself, and to the successive coverings, partial and complete, in which the stony globe is wrapped. We sometimes hear of the New Geography,

but I think it is more profitable to consider the present position of Geography as the outcome of the thought and labours of an unbroken chain of workers, continuously modified by the growth of knowledge, yet old in aim, old even in the expression of many of the ideas that we are apt to consider the most modern.

Some Historical Landmarks. — Claudius Ptolemæus, about 150 A.D., gathered into his great *Geography* the whole outcome of the Greek study of the habitable world. He laid stress on the threefold nature of descriptions of the Earth's surface: the general sketch of the great features of the world alone receiving the name of Geography, the more special description of an area he termed Chorography, and the detailed account of a particular place Topography.

Aristotle, who first adduced real proofs of the sphericity of the Earth, had not failed to note the relationships which exist between plants and animals, and the places in which they are found, and he argued that the character of peoples was influenced by the land in which they lived; but Ptolemy cared little for theories, comparisons, or relationships, confining himself rather to the record of actual facts. He made errors, the results of which were more important, as it happened, in advancing knowledge than were the truths which he recorded; for after the troubled mediæval sleep, when even the spherical form of the Earth was blotted out of the knowledge of Christendom, the scientific deductions made by Toscanelli from the false premises of Ptolemy heartened Columbus for his westward voyage to the Indies, on the very outset of which he stumbled all unknowing on the New World. When Magellan succeeded in the enterprise which Columbus had commenced, the fourteen centuries' reign of Ptolemy in geography came to an end; his work was done.

The rapid unveiling of the Earth in the sixteenth and seventeenth centuries cast a glamour over feats of exploration which has not yet been wholly dissipated, and it may not be easy, even now, to obtain wide credence for the fact that the explorer is usually but the collector of raw material for the geographer.

It is of vital interest to trace the re-formation of the theory of geography after its interruption in the Middle Ages. The fragments of the old Greek lore were cemented together by new and plastic thoughts: crudely enough by Apian, Gemma Frisius, and Sebastian Munster in the sixteenth century, but with increasing strength and completeness by Cluverius, Carpenter, and Varenius in the seventeenth.

The First Oxford Geographer.—The names of Cluverius and Varenius are familiar to every historian of geography; but that of Carpenter, I am afraid, is now brought to the notice of many geographical students for the first time. He was not so great as Varenius; but he was the first British geographer to write on theoretical geography as distinguished from mathematical treatises on navigation or the repetition of narratives of travel, and I think that there is evidence to show that his work had an influence on his great Dutch contemporary.

Nathaniel Carpenter, Fellow of Exeter College, Oxford, published his book in 1625 under the title—

"Geographie delineated forth in two Bookes. Containing the Spherical and Topicall parts thereof," and with the motto from Ecclesiastes on its title-page—

"One generation commeth, and another goeth, but the Earth remayneth for ever."

The great merits of Carpenter's treatise are his firm grasp of the relation of one part of geography to another, his skilful blending of the solid part of the work of Aristotle and Ptolemy with that of the explorers and investigators of his own generation, and the wholesome common-sense that dominates his reasoning. His definition is comprehensive and precise :

"Geographie is a science which teacheth the description of the whole Earth. The Nature of *Geographie* is well expressed in the name: For *Geographie* resolved according to the *Greeke* Etymologie signifieth as much as a description of the Earth; so that it differs from *Cosmographie*, as a part from the whole. Forasmuch as *Cosmographie* according to the name is a description of the whole world, comprehending under it as well *Geographie* as *Astronomie*. Howbeit, I confesse, that amongst the ancient Writers, *Cosmographie* has been taken for one and the self-same science with *Geographie* as may appeare by sundry treatises meerely Geographicall, yet intituled by the name of *Cosmographie*."

The differences held by Ptolemy to distinguish geography from chorography Carpenter shows to be merely accidental, not essential, and as to geography he says "It is properly tearmed a *Science*, because it proposeth to it selfe no other end but knowledge; whereas those faculties are commonly tearmed *Arts*, which are not contented with a bare knowledge or speculation, but are directed to some farther work or action. But here a doubt seems to arise, whether this *Science* be to be esteemed *Physicall* or *Mathematicall*? Wee answer, that in a Science two things are to bee considered: first, the *matter* or object whereabout it is conversant; secondly, the *manner* of handling and explication: For the former no doubt can bee made but that the object in *Geographie* is for the most part *Physicall* consisting of the parts whereof the Spheare is composed; but for the manner of Explication it is not *pure* but *mixt*; as in the former part *Mathematicall*, in the second rather *Historicall*; whence the whole Science may be alike tearmed both *Mathematicall* & *Historicall*; not in respect of the *subject* which we have said to be *Physicall* but in the manner of *Explication*."

Although somewhat diffuse in expression, the meaning of these statements is clear and sound, and to the British public as new now as it was in the days of King Charles. The book treats of mathematical geography and cartography, of magnetism, climates, the nature of places, of hydrography, including the sea, rivers, lakes and fountains, of mountains, valleys and woods, of islands and continents, and at considerable length of people and the way in which they are influenced by the land in which they live. Whether Dr. Carpenter lectured on geography in Oxford I do not know, but his book must have acquired a

certain currency, for a second edition appeared in 1635, and it seems probable that it was known to Varenius.

Varenius and Newton.—Varenius, a young man who died at twenty-eight, produced in Latin a single small volume published in 1650, which is a model of conciseness of expression and logical arrangement well worthy even now of literal translation into English. So highly was it thought of at the time that Sir Isaac Newton brought out an annotated Latin edition at Cambridge in 1672.[1] The opening definition as rendered in the English translation of 1733 (a work spoilt in most places by a parasitic growth of notes and interpolations) runs :—

"Geography is that part of *mixed mathematics* which explains the state of the Earth and of its parts, depending on quantity, viz. its figure, place, magnitude, and motion with the celestial appearances, etc. By some it is taken in too limited a sense, for a bare description of the several countries; and by others too extensively, who along with such a description would have their political constitution."

Varenius produced a framework of Physical Geography capable of including new facts of discovery as they arose; and it is no wonder that his work, although but a part, ruled unchallenged as the standard text-book of pure geography for more than a century. He laid stress on the causes and effects of phenomena as well as the mere fact of their occurrence, and he clearly recognised the vast importance upon different distributions of the vertical relief of the land. He did not treat of human relations in geography, but, under protest, gave a scheme for discussing them as a concession to popular demands.

Kant.—As Isaac Newton, the mathematician, had turned his attention to geography at Cambridge in the earlier part of the eighteenth century, so Immanuel Kant, the philosopher, lectured on the same subject at Königsberg in the later part. The fame of Kant as a metaphysician has defrauded him of much of the honour that is his due as a man of science. As Professor Hastie puts it: "His earlier scientific work, like an inner planet merged in light, was thus almost entirely lost sight of in the blaze of his later philosophical splendour."

Kant, it will be remembered, considered that the communication of experience from one person to another fell into two categories, the historical and the geographical: that is to say, descriptions in order of time or in order of space. The science of geography he considered to be fundamentally physical, but physical geography formed the introduction and key to all other possible geographies, of which he enumerated five: *mathematical*, concerned with the form, size, and movements of the Earth and its place in the solar system: *moral*, taking account of the customs and characters of mankind according to their physical surroundings; *political*, concerning

[1] Dugdale, in the introduction to the English translation published in 1733, states explicitly that Newton produced his version for the benefit of the students attending his lectures "on the same subject" from the Lucasian chair; but we have been unable to find any more satisfactory evidence that Newton actually lectured on Geography at Cambridge.

the divisions of the land into the territories of organised governments: *mercantile*, or, as we now call it, commercial geography; and *theological*, which took account of the distribution of religions. It is not so much the cleavage of geography into five branches, all springing from physical geography like the fingers from a hand, which is worthy of remark, but rather the recognition of the interaction of the conditions of physical geography with all other geographical conditions. The scheme of geography thus acquired an unity and a flexibility which it had not previously attained, but Kant's views have never received wide recognition. If his geographical lectures have been translated, no English or French edition has come under my notice; and such currency as they obtained in Germany was checked by the more concrete and brilliant work of Humboldt, and the teleological system elaborated in overwhelming detail by Ritter.

The teleological views of Ritter were substantially those of Paley. The world, he found, fitted its inhabitants so well that it was obviously made for them down to the minutest detail. The theory was one peculiarly acceptable in the early decades of the nineteenth century, and it had the immensely important result of leading men to view the Earth as a great unit with all its parts co-ordinated to one end. It gave a philosophical, we may even say a theological, character to the study of geography.

Kant's views had pointed to such an unity, but from another side, that of evolution. It was not until after Charles Darwin had fully restored the doctrine of evolution to modern thought that it was forced upon thinking men that the fitness of the Earth to its inhabitants might result not from its being made for them, but from their having been shaped by it. It is certain that the influence of the terrestrial environment upon the life of a people has been carried too far by some writers—by Buckle, in his *History of Civilisation*, for example—but it is no less certain that this influence is a potent one.

The Nature of Geography.—Granted that such influence is exercised, some objectors may urge that geography has nothing to do with the matter; and we are compelled to acknowledge that the meaning and contents of geography are in this country as variously interpreted as the colour of the chameleon in the traveller's tale. Yet my thesis is that it is just this relation between the forms of the solid crust of the Earth and all the other phenomena of the surface that constitutes the very essence of geography.

It is a fact that many branches of the study of the Earth's surface which were included in the cosmography of the sixteenth century, the physiography of Linnæus, the physical geography of Humboldt, and perhaps even the *Erdkunde* of Ritter, have been elaborated by specialists into studies which, for their full comprehension, require the whole attention of the student. Geology, meteorology, oceanography, and anthropology, for example, have been successively specialised out of geography; but it does not follow that these specialisations fully occupy the place of geography, for that place is to co-ordinate and correlate all

the special facts concerned so that they may throw light on the plan and the processes of the Earth and its inhabitants. Geography, in fact, is concerned with the results, not with the processes of the special sciences; and the limits between geography and geology, to take a single instance, are to be drawn, not between any one class of phenomena and another, but between one way and another of marshalling and utilising the same facts. This was clear to Carpenter in 1625, though we have almost forgotten both it and him.

The Principles of Geography.—The principles of geography—the "pleasant principles," to use the phrase of old William Cuningham in 1559—on which its claims to status as a science rest are generally agreed upon by modern geographers, though with such variations as arise from differences of standpoint and of mental process. The evolutionary idea is unifying geography as it has unified biology, and the whole complicated subject may be presented as the result of continuous progressive change brought about and guided by the influence of external conditions. These views have been expressed often in recent years, but they do not seem to have been very seriously considered, and no excuse need be offered for presenting them once more, though in an epitome curt to baldness.

The science of geography is of course based on the mathematical properties of a rotating sphere; but if we define geography as the exact and organised knowledge of the distribution of phenomena on the surface of the Earth, we see the force of Kant's classification, which subordinated mathematical to physical geography. The vertical relief of the Earth's crust shows us the grand and fundamental contrast between the oceanic hollow and the continental ridges; and the hydrosphere is so guided by gravitation as to fill the hollow and rise upon the slopes of the ridges to a height depending on its volume, thus introducing the great superficial separation into land and sea. The movements of the water of the ocean are guided in every particular by the relief of the sea-bed and the configuration of the coast lines. Even the distribution of the atmosphere over the Earth's surface is affected by the relief of the crust, the direction and force of the winds being largely dominated by the form of the land over which they blow. The different physical constitution of land, water, and air, especially the great difference between the specific heat and conductivity or diathermancy of the three, causes changes in the distribution of the sun's heat, and as a result the simple climatic zones and rhythmic seasons of the mathematical sphere are distorted out of all their primitive simplicity. The whole irregular distribution of rainfall and aridity, of permanent, seasonal, and variable winds, of sea-climate and land climate, is the resultant of the guiding action of land forms on the air and water currents, disturbed in this way from their primitive theoretical circulation. So far we see the surface forms of the Earth, themselves largely the result of the action of climatic forces, and constantly undergoing change in a definite direction, controlling the two great systems of fluid circulation. These in turn control the distribution of plants and animals, in conjunction with the direct action of surface

relief, the natural regions and climatic belts dictating the distribution of living creatures. A more complicated state of things is found when the combined physical and biological environment is studied in its incidence on the distribution of the human race, the areas of human settlement, and the lines of human communications. The complication arises partly from the fact that each of the successive earlier environments acts both independently and collectively: but the difficulty is in greater degree due to the circumstance that man alone among animals is capable of reacting on his environment and deliberately modifying the conditions which control him.

It seems to me that the glory of geography as a science, the fascination of geography as a study, and the value of geography in practical affairs, are all due to the recognition of this unifying influence of surface relief in controlling, though in the higher developments rather by suggestion than dictation, the incidence of every mobile distribution on the Earth's surface.

The Classification of Geography.—Following out this idea, we are led to a classification of the field of geography in a natural order, in which every department arises out of the preceding with no absolute line of demarcation, and merges into the succeeding in the same way. This classification, it is necessary to note, is not like a series of pigeon-holes, which may be placed in any arbitrary order, but like a chain, in which the succession of the links is essential and unalterable.

Since form and dimension are the first and fundamental concepts in geography, the first and basal division is the *Mathematical.* Mathematical geography leaves the Earth as a spinning ball lighted and warmed according to a rigid succession of diurnal and annual changes. This merges into the domain of *Physical Geography,* which involves the results of contemporary change in the crust and the circulation of the fluid envelopes, with the resulting modifications in the simple and predictable mathematical distributions. This division falls naturally into three parts: Geomorphology, dealing with the forms of the solid crust and the changes they are undergoing at the present time; Oceanography, dealing with the great masses of water in the world; and Climatology, dealing with the effects of solar energy in the air. But all three spheres —lithosphere, hydrosphere, and atmosphere—are so closely inter-related that no one of them can be studied without some preliminary knowledge of the others. This forms the largest and most important part of geography, more varied and intricate than the mathematical, better known, and more definite than those involving life.

Bio-geography, the geographical distribution of life, arises directly from physical geography, which dominates it, but it is full of complex questions which involve the biological nature of the organism and the influence of physical environment, in which geographical elements, although predominant, do not act alone. Difficult as some of the problems of the distribution of life are at the present day, the remains of living creatures found fossil in the rocks, and the survivors of archaic forms still lingering in remote islands, supply us with our only instru-

ment of research into the geography of past ages, often making it possible to lay down the areas of land and water in earlier geological periods.

The relation of man to the surface of the Earth detaches itself from the rest of Bio-geography by the number of exceptions to general laws of distribution and by the human power of modifying environment. It has necessarily been formed into a special department, *Anthropo-geography*. In primitive man the control exercised by environment is nearly as complete and simple as in the case of the lower animals; but with every advance in culture fresh complications are introduced. The relation of people to the land they inhabit, the choice of sites for dwellings and towns, the planning and carrying into effect of lines of communication, are all obviously much under the control of land form and climate. When people get settled in a favourable position they usually become attached to it; they acquire, one may say, the colour of the land, in modes of thought as well as in manner of life. The poems of Ossian and the Crofter Question require for their elucidation a knowledge of the geographical conditions of the Western Highlands, just as the Border ballads and the Border raids were largely conditioned by the geography of the Southern Uplands.

Attachment to the native valley or the native fields leads to the holding of lands by clans or tribes and the fusion of tribes into nations, while changes in physical conditions stimulating migration from a deteriorating country may lead to the invasion of settled territories by homeless hordes. Here Anthropo-geography buds off the subdivision of *Political Geography*, which takes account of the artificial boundaries separating or subdividing countries, and of the innumerable artificial restrictions and ameliorations which are superimposed on the natural barriers and channels of intercommunication. Even in political geography only a humble place is held by a statement of boundaries and capitals, to lists of which the great name of Geography has actually been confined by people who ought to have known better.

Anthropo-geography views the world from the standpoint of the race, political geography from the standpoint of the nation: but room has to be found for a yet more restricted outlook, that of the individual, whose view of the world as it profits himself is known as commercial geography. This department deals with natural commodities and their interchange, and perhaps because here rather than in the other departments a successful comprehension of the inter-relation of cause and effect may be, in the language of the schoolroom, "reduced to pounds, shillings, and pence," the name of Applied Geography has been proposed. It fitly terminates our survey of the science, for the flickering disturbances of the equilibrium of supply and demand known simultaneously over the whole world, and the slower movements of transport to restore equilibrium, are still far from the power of scientific prevision, and all we can do at present is to point out certain clear lines of least resistance, or greatest advantage, due to the interactions of natural and human causes and effects.

To sum up in a sentence the field and the function of geography in

the broad majesty of its completeness, we may say that it is the description of the surface of the solid Earth as it is in itself, as it acts upon the ocean, the air, and the living things which inhabit it, and as it is affected in turn by their actions.

Geography and the State.—Viewed thus, I believe that geography will be found to afford an important clue to the solution of every problem affecting the mutual relations of land and people, enlightening the course of history, anticipating the trend of political movements, indicating the direction of sound industrial and commercial development.

It would be possible, unfortunately it would be easy, to enumerate misconceptions of history, blunders in boundary settlements, errors in foreign policy, useless and wasteful wars, mistakes in legislation, failures in commercial enterprise, lost opportunities in every sphere, which are due to the neglect of such a theoretical geography. Surely it is to the laws defining the interaction of Nature and Man that we should turn for guidance in such affairs, rather than to the dull old British doctrine of "muddling through." That vaunted process after all means that we are driven by stress of facts to do without intending it, or knowing how, and at immense expense, the very things that intelligent study beforehand would have shown to be necessary, feasible, and cheap.

All this has been urged again and again, and it has fallen on the ears of those in authority "like a tale of little meaning though the words are strong." I admit that all advocates of a rational geography have not escaped the danger of the special pleader—they have promised too much. If a government official were to say: "Yes, I confess there was a mistake here, the affair was managed badly, much money and some prestige were lost: it must all be done over again; please tell me how"; I am afraid that the chances are that the answer would be vague, general and unpractical. If the answer to this boldly hypothetical question is ever to be clear and definite, geography must be studied as it has never yet been studied in this country. It must pass beyond the stage of a pastime for retired officers, colonial officials, and persons of leisure, and become the object of intense whole-hearted and original study by men of no less ability who are willing to devote, not their leisure, but their whole time to the work. The object of geographical research should be nothing less than the demonstration or refutation of what we claim to be the central principle of geography—that the forms of terrestrial relief control all mobile distributions.

A Projected Geographical Description.—In order to focus the question it may be convenient to consider the geography—or chorography, as Ptolemy would have termed it—of the British Islands. No author has ever attempted to give such a description. Camden's *Britannia* was swamped by archæology; the county histories, which are certainly not deficient in number, were wrecked outward bound on the harbour-bar of genealogy. Sir John Sinclair's old *Statistical Account of Scotland* in the intelligent utilisation of very incomplete data was a great but solitary stride in the right direction. Bartholomew's great *Atlas of Scotland* supplies the cartographical basis for a modern description of the northern

kingdom; but the description itself has not been undertaken on an equal scale. The work of producing a complete geographical description of the British Islands would be gigantic, but not hopelessly difficult.

The material has been collected at an enormous expenditure of public money, and is stacked more or less accessibly, much of it well-seasoned, some I fear spoilt by keeping; but there it lies in overwhelming abundance, heaps of building materials, but requiring the labour of the builder before it can become a building.

There is first and chief the Ordnance Survey, one of the grandest pieces of work in mathematical geography that has ever been accomplished. The result is a series of maps almost as perfect as one can expect any human work to be, showing in a variety of scales from $\frac{1}{4}$ of an inch to 25 inches to a mile every feature of the configuration of the land—except the lake-beds.

There is next the hydrographic survey by the Admiralty, giving every detail of the subaqueous configuration in and around our islands—except the lake-beds.

These two great surveys supply the basis for a complete description of the British Islands, and the geological survey, which in a sense is more elaborate than either of the others, completes the fundamental part. The geological map makes it possible to explain many of the forms of the land by referring to the structure of the rocks which compose them. Both the geological and hydrographic surveys are accompanied by memoirs describing the features, and discussing the various questions arising from the character of each sheet; but there is nothing of the kind for the maps of the ordnance survey.

The ordnance maps show at the date of their preparation the extent and also the nature of the woodlands and moorlands, and this information is supplemented by the Returns of the Board of Agriculture, which each year contain the statistics of farm crops, waste land, and livestock for every county. These returns are excellently edited from the statistical point of view, but they are not discussed geographically. It is easy to see in any year how much wheat is raised in each county, but it is a slow and laborious process to discover from the Returns what are the chief wheat-growing areas of the country. The county is too large a unit for geographical study, as it usually includes many types of land form and of geological formation. Before the distribution of crops can be understood or compared with the features of the ground they must be broken up into parishes, or even smaller units, and the results placed on maps and generalised. The vast labour of collecting and printing the data is undertaken by Government, and paid for by the people without a murmur, but the geographer is left in ignorance for the want of a comparatively cheap and simple cartographic representation of the facts.

The Inspectors of Mines and the Board of Trade publish statistics of the industry and the commerce of the country, statistically excellent, no doubt, but in most cases lacking the cartographic expression which makes it possible to take in the general state of the country from year to year. The same is true of the Registrar-General's Returns of births, marriages, and deaths, in themselves an admirable epitome of the health

conditions of the country, and of the fluctuations in population, but limited by a narrow specialism to the one purpose.

Finally and chiefly we have the Census Reports. Once in ten years the people are numbered and described by sex, age, and occupation. The inhabited houses are numbered, and the smaller dwellings grouped according to size. The figures are most elaborately classified and discussed, so as to bring out the distribution of population, and its change from the previous decade. But to the geographer the Census Reports are like a cornfield to a seeker of bread. The grains must be gathered, prepared, and elaborated before the desired result is obtained. Nowhere is the cartographic method more useful than here. It is a striking contrast to turn to the splendid volumes of the United States Census Reports, many of them statistically inferior to ours, but thickly illustrated with maps, showing at a glance the distribution of every condition which is dealt with, and enabling one to follow decade by decade the progressive development of the country, and to study for each census the relations between the various conditions.

These are only a few of the statistical publications, produced by Government, and embodying year after year a mass of conscientious labour, which, save for a few specialists who extract and utilise what concerns themselves, is annually "cast as rubbish to the void."

One small department supported by public money, but under unofficial direction, may be referred to as an example of the successful employment of cartographic methods. This is the Meteorological Council, appointed by the Royal Society, and charged with the collection of meteorological data and the publication of weather reports, forecasts, and storm warnings. The maps published twice daily to show the distribution of atmospheric pressure and temperature are only rough sketches and very much generalised, yet they serve the purpose of presenting the facts in a graphic form, yielding at a glance information which could only be extracted from tables by long and laborious efforts. The pilot charts, published monthly by the same department, showing the average conditions of air and sea over the whole North Atlantic, and the occasional atlases of oceanographical data, are valuable geographical material.

The official work of Government is supplemented by the voluntary labours of many societies, in whose transactions much valuable material is stored, and in not a few cases is admirably discussed. But even with these supplements gaps remain which must be filled by private enterprise before a complete geographical description can be compiled.

Considering the Ordnance Survey alone it is hardly credible and not at all creditable that the Treasury should veto the extension of the survey to the lake-beds on the score of expense, yet such is the fact. The directors of the Survey have shown themselves ready to encourage private workers by placing the data presented by them upon the maps with due acknowledgment.

The Survey of the Lakes.—It is with profound satisfaction that I now make an announcement—by special favour the first public announcement—of a scheme of geographical research on a national scale by private

enterprise. Sir John Murray and Mr. Laurence Pullar have resolved to complete the bathymetrical survey of all the fresh-water lakes of the British Islands. Mr. Laurence Pullar will take an active part in the proposed survey, and has made over to trustees a sum of money sufficient to enable the investigation to be commenced forthwith and to be carried through in a comprehensive and thorough manner. It is intended to make the finished work an appropriate and worthy memorial of Mr. Pullar's son, the late Mr. Fred Pullar, who had entered enthusiastically upon the survey of the lochs of Scotland, and whose heroic death while endeavouring to save life in Airthrey Loch last February must be present to the memory of many of you. Large sums of money devoted in good faith to scientific purposes do not always bring about the wished-for result; but in this case there is no room for anxiety on that score. Sir John Murray, with whom Mr. Fred Pullar had worked for several years, has generously promised to direct the whole scheme, and to be responsible for carrying it out. All the lakes of the British Islands will be sounded and mapped as a preliminary to the complete limnological investigation which is proposed. The nature of the deposits, the chemical composition of the water and its dissolved gases, the rainfall of the drainage areas, the volumes of the inflowing and outflowing streams, the fluctuations in the level of the surface, the seasonal changes of temperature, and the nature and distribution of aquatic plants and animals, will all receive attention. The geological history of the lakes may also be inquired into with reference to such points as the growth of deltas, the erosion of the margins, and, perhaps, the conditions of the old dead lakes that are now level meadows.

Five years at least will be required to make these observations and to incorporate them in memoirs, each of which will be a complete natural history of the lakes of one river basin. The proposed work wants more than money, direction, and time. It requires the services of several young and enthusiastic workers—preferably men who have completed their University course and are anxious to devote some time to research. Sir John Murray and Mr. Pullar wish to meet three or four capable young fellows, one preferably a chemist, one a geologist, one a botanist, and one a zoologist. When found they will be offered a salary sufficient to enable them to give their whole time to the work, but not large enough to induce any one who has not the love of science at heart to take it up. From my experience when working in somewhat similar conditions at the Scottish Marine Station seventeen years ago, I can promise those who will have the good fortune to be selected plenty of hard work for which they will get the fullest credit—and this they will appreciate more keenly when they come to know the world better—and I can promise them also in their association with Sir John Murray a course of scientific and intellectual training such as even the universities do not afford.

Other Desirable Surveys.—The Geological Map requires to be supplemented by additional work on the nature of the superficial soil as it affects agriculture, such as is expressed in the *Cartes agronomiques* of France, going more fully into the chemical nature of the soil than is

possible on the Drift Maps of the Survey which so usefully supplement the maps of solid geology. Such experiments as have been made at the College at Reading in collecting analyses of the soils in the neighbourhood might very well be carried out at the agricultural colleges and other centres all over the country. It would form an invaluable supplement to the work of the Government geologists.

Of equal value, though, perhaps, more obviously so to the scientific than to the "practical" man, is the study of the natural vegetation of the country. In a highly cultivated land like ours there are comparatively few places where the native flora remains in possession; but the mapping of the main crops which have supplanted it is nearly as useful. To become satisfactory from this point of view, the statistics of the Board of Agriculture ought to be supplemented by surveys made by trained botanists on the ground. A valuable beginning has been made under the ever-fertile stimulus of Professor Patrick Geddes in the two sheets of a map of the plant-associations of Scotland compiled by the late Robert Smith, whose premature death last year was a loss to science. It would be a splendid thing if this map could be finished as a memorial to the brilliant young botanist in the same way as the survey of the lakes is proposed as a memorial worthy of Fred Pullar, and I am glad to learn that there is some probability of it being carried on.

Of all the other distributions which might be worked out cartographically time fails us to speak; but reference must be made, however briefly, to a few.

Geography of the Air.—With regard to Meteorology, the distribution of temperature and pressure over the British Islands for the year and for the separate months have been worked out by the experienced hand of Dr. Buchan, and published both in separate memoirs and in the *Meteorological Atlas*, edited by Dr. Buchan and Dr. Herbertson. But such observations as the degree of cloud or of sunshine can as yet be treated only in a superficial and generalised way for want of data. Perhaps the most important and certainly the most difficult of all the atmospheric conditions to discuss fully is precipitation. It depends on so many varying conditions, such as the form and exposure of the land, the altitude above sea-level, the direction and force of the wind, the relative frequency of thunderstorms, the distance from the sea, the direction of the average paths of cyclonic storms, etc., that far more numerous and more long-continued observations are required to establish the normal condition of the country than in the case of either temperature or pressure. When we reflect that the whole water-supply of the country depends directly on rainfall, and when we remember that the value of water-power made available by differences of level promises to be greater in the future than it has been in the past, we can see that a study of rainfall in conjunction with configuration may prove as valuable for the localisation of the manufacturing centres of the future as the geological survey was for those of the present.

Thanks to the remarkable foresight and the untiring exertions of the late Mr. Symons, the volunteer rainfall observers of this country have

been encouraged to organise their efforts, and by working on a common plan have accumulated within the last forty years a mass of observations unrivalled for number and completeness in any other land. But as yet the difficulties in the way of constructing a map of normal rainfall on an adequate scale have not been overcome, and much experimental work will probably be necessary before it can be accomplished. To this task it is my ambition to devote myself. I may be permitted to state that Scotland is far behind England or Wales in the number of rainfall stations per square mile. Thus there is, roughly, one rain-observing station for every 20 square miles of England, one for every 30 square miles of Wales, but only one for every 67 square miles of Scotland, and one for every 170 square miles of Ireland.

Rainfall observations only tell the amount of available water; the configuration of the stream-beds must be considered in determining water-power. The only country I know where the horse-power of the rivers has been measured and mapped is Finland, but of course individual rivers, such as the Mississippi, Rhine, Seine, and Thames, have been thoroughly studied. Before many decades have passed it will be a necessary element in the surveys of all countries, though at present the available data are few and scattered.

Population Maps.—In considering human geography we come to the most interesting and least occupied field of research. Until Mr. Bosse constructed his beautiful maps of the density of population of Scotland and England we had absolutely no cartographical representation of the true distribution of people over the land. To map population by counties gives a very poor idea of the truth, for in such counties as Yorkshire or Perthshire there are large areas entirely without inhabitants, and small areas where the population is very dense. Mr. Bosse's maps were made on the principle of leaving blank all the land on which there were no dwelling-houses, and so obtaining a close approximation to the true density of population of the inhabited area. For Scotland his map shows at once that it is a function of configuration. It shows the densely peopled lowland plain, the less densely peopled coast-strip surrounding the country, and the less densely peopled valleys running inland into the great uninhabited areas. The population map of England, on the other hand, shows an absolutely startling relation to the geological structure, which in turn is closely related to the configuration. We are not astonished to see the centres of densest population coinciding with the Coal Measures, but it is both surprising and instructive to see how the density of population runs parallel to the strike of the Secondary and Tertiary rocks of south-eastern England, a band of the lightest population following each outcrop of chalk and limestone, a band of dense population following each belt of sandstone or clay.

Anthropo-geography teems with fascinating subjects of research. The admirable investigations in the West of Ireland on the physical anthropology of the people might well be extended to the whole country outside the great towns, where all evidence of place of origin and original character is speedily lost. Good work has been done in this way by the

Ethnographic Survey promoted by a committee of this Association, and a committee of the Royal Scottish Geographical Society has rendered great aid to the Ordnance Survey in the cognate study of the place-names of Scotland.

The distribution of religion, even in the three typical forms of Anglican, Presbyterian, and Roman Catholic—forms so typical as to be, broadly speaking, national—is most imperfectly known. The objection to a religious census is one which is somewhat difficult of comprehension in Scotland, and too polemic for sober discussion in England. But a few of the problems are worth being worked out by individuals. The curious islands of Roman Catholic continuity in Lancashire, the Hebrides, and the Highlands can probably be related simply enough to the configuration of the country and the means of communication as influencing free movement of people at critical periods of history. There are many interesting points as to the geographical distribution of surnames, the relation of characteristic literature or poetry to specific areas, things small in themselves, but capable of exercising very far-reaching influence if systematically worked out.

Geographical Synthesis.—Granted that the subsidiary surveys have been made and the results put in a strictly comparable form, the central problem remains—the synthesis of the complete geography of the country. This can perhaps be solved best by comparing the maps of the various distributions in the proper order, and seeing how far they are related to one another. For the general discussion the Ordnance Map on the scale of 1 inch to a mile should be used, and each natural region ought properly to be treated by itself, but as a matter of practical convenience it would probably be found best to select either the artificial boundaries of counties or the still more arbitrary lines bounding sheets of the map. Whatever small area is taken as the unit of description, it should be treated in such a way as to seek for and prove or disprove the existence of any control exercised by the form of the land and its geological character on the outcrops of the rocks, the nature of the soil, the course of the rivers, the temperature and movements of the air, the rainfall, the vegetation and agriculture, the distribution of population, the sites of towns, villages, and isolated dwellings, the roads, railways, and harbours, the birth-rate and death-rate, and on the progressive changes in all these conditions which are shown in the discussion of the statistics collected annually or decennially. When such unit areas are worked out individually the results can easily be combined and condensed into a geographical description that will be complete, well balanced, and symmetrical. The work is practicable; it only requires time, money, direction, and workers to carry it out; but although a specimen memoir, prepared by the authority of the Royal Geographical Society, met with a certain measure of approval, all attempts failed to obtain funds for making the work complete, and the scheme must await a more educated generation before it can be profitably revived in its entirety. But meanwhile this field for geographical study and research lies at the doors of every university where the subject is or may be recognised, and the labours of professors and

students might be profitably directed to the completion of such memoirs for the surrounding district, gradually working farther and farther afield. The idea is no more new than every other "thing under the sun." Such exercises, not so elaborately planned, but the same in essentials, were ordinary subjects for theses in the universities of Sweden and Finland during the eighteenth century. To come nearer home, the local handbooks prepared for successive meetings of the British Association are frequently very fair examples of the geographical description of a district. The essential qualities are rarer in guidebooks, but we must not forget one brilliant exception, the poet Wordsworth's *Guide to the English Lakes*.

It is pleasant to hear that through the encouragement of Sir John Murray the Scottish Natural History Society is taking up the systematic study of the basin of the Forth, and they will, I feel sure, give a good account of their labours. One point which must be very strongly emphasised is that a geographical treatise is distinguished from a jumble of facts mainly by the order and proportion in which the phenomena are dealt with, and by the relation of cause and effect that is established between them.

As to the utility of complete geographical descriptions, we must of course recognise their greater practical importance in new and developing countries than in old lands like our own. Yet even with us the study of the distribution of natural resources may suggest important changes, involving great redistributions of population.

A Geographical Warning.—Hitherto, except as regards exploration and cartography, the position of geography in this country has never been satisfactory. Times are changing, and even in exploration we are now only one amongst many rivals, often better equipped by education, usually in no way deficient in daring. Although the best work of several of our cartographers in Edinburgh and London need fear no comparison, we cannot conceal the fact that Germany leads the world in map-making. As regards the recognition or even the comprehension of geography by the State, by the universities, and by the public, we are equally far behind our neighbours across the North Sea.

It has sometimes been hinted that the study of geography has been deliberately discouraged by politicians or by merchants because too much knowledge on the part of the public might embarrass foreign policy or lead to mercantile competition: but we surely cannot entertain such unworthy suspicions. I am inclined to attribute the neglect of the subject merely to ignorance of its nature due to imperfect education.

Two cases in which the application of geography to political and practical affairs suggests a definite course of action may be mentioned as examples. There is still one important colonial boundary, entirely undelimited in a region somewhat difficult of access and still little known, where goldfields will probably be found or reported before long, and where a very serious international question may suddenly arise in a part of the world absolutely unsuspected by most people, even amongst those who interest themselves in general politics and in colonial affairs. It would cost a comparative trifle to survey the region in question, and to

lay down that boundary line before the goldfields are touched, so that no international trouble could ever arise. What it may cost to postpone the matter until claims have been pegged out on debatable land, the British Guiana and Venezuela arbitration, the Alaska difficulty, and South Africa are there to tell us. It would be interesting to calculate, now that the cost of a week of fighting is known, the saving in pennies on the income-tax that would have accrued from a survey of South Africa if that had been carried out as an imperial duty when Cape Colony was settled. I do not for a moment suggest that a survey would have prevented the war; but it is not unreasonable to believe that it would have shortened it by some months. In this connection it is satisfactory to know that a valuable report has been drawn up by a Committee of the British Association, presided over by Sir Thomas Holdich, embodying a scheme for the systematic survey of British protectorates.

The second example comes nearer home. The utilisation of wind- and water-power must increase in importance as mineral fuel diminishes in amount or increases in price. Wind- and water-power will never fail as long as the sun shines and the land remains higher than the sea; but what may fail unless timely precautions are taken is the power of utilising them for the benefit of the community at large. Are the existing laws as to water-rights, and the absence of laws as to the utilisation of wind desirable and satisfactory? The usual answer to such questions is, "Why trouble about that just now? These matters are not urgent, other things are." That argument is answerable for many disasters. The inevitable is in many if not in most cases simply another name for the unforeseen. It is inevitable that the country will be impoverished if the utilisation of wind- and water-power and the transport of that power by electricity are not wisely safeguarded and provided for; but when a survey of our resources, the circulation of the air over our islands, and the effects produced by the interposition of the mountains, plateaus, and valleys upon it, plainly points to the possibility of such a trouble, it only becomes inevitable as a result of culpable negligence.

These two examples, which will not strike any one whose mind is wholly occupied in paying the penalties of old neglect, illustrate my contention that a complete geographical description based on full investigation is of the highest and most urgent importance, not for this country only, but for the Empire, and for every country in the world.

Nor is it the land alone which claims attention. It is of the utmost importance to investigate and evaluate the resources of the surrounding seas. The recent International Conference for the exploration of the sea held at Christiania formulated a scheme of research which has been taken up enthusiastically by Belgium, Holland, Germany, Denmark, Russia, Sweden, and Norway. Its object is to place the fisheries of Northern Europe on a scientific basis, and to make for that purpose a comprehensive survey of the sea, which will prove of high value to meteorology, and through it to agriculture as well. The recent work by Mr. H. N. Dickson on the circulation of the surface waters of the North Atlantic in conjunction with similar work by Professor Pettersson in Sweden shows how hopeful

such researches are from the purely scientific standpoint, and their practical importance is no less. It remains with our Government to show that this country is not indifferent to an opportunity, such as has never presented itself before, of placing one of our great national industries on a basis of scientific knowledge. This is in my belief one of the cases in which the expenditure of thousands now will mean the saving of millions a few years hence.

It is magnificent to send out Polar expeditions, and they speak volumes for the greatness of the human mind that can give itself to the advancement of knowledge for the sake of knowledge, knowing that it will bring no material gain; and I trust that such a spirit will continue to manifest itself until no spot of Earth, no land however cold or hot, no depth of sea, no farthest limit of the atmosphere remains unsearched and its lesson unlearnt. But I insist that the full study of our own country is on a totally different footing. Magnificent it may be, too, but sternly practical, since it is absolutely essential for our future well-being, and even for the continuance of the nation as a Power amongst the states of the world. Still, there is every probability that such work will be neglected until the events which it should avert are upon us, and then it will be too late to make provisions which now could be done cheaply, easily, and effectively.

A Proposed Remedy.—The few attempts which have been made in this country to promote the study of geography or to diminish the discouragements to geographical research have had but slight success. Much has been done to improve geographical teaching by the Royal Geographical Society, the Royal Scottish Geographical Society, the Geographical Association, this Section of the British Association, and other bodies: but that is not my theme. I refer to the little that has been done towards the elaboration of a geographical theory and the elucidation of geographical processes. Amongst the not inconsiderable number of teachers of geography in the universities and colleges of Great Britain there is not one man who receives a salary on which he can live in decent comfort so as to devote all his time, or a substantial part of it, to geographical research; and the same is true of every official of all the geographical societies. Not one is paid an income sufficient to enable him to devote the time not occupied by mechanical routine to any other purpose than supplementing his income by outside work—writing text-books, correcting examination papers, perhaps even practising journalism. If by an effort and the sacrifice of some of the comforts considered necessary by most people of the professional classes he devotes a few odd hours now and then to some original research, he finds very few to consider it seriously: some friendly expressions of opinion possibly, but scarcely a reader; and it counts for nothing, save, perhaps, in enhancing the reputation of his country in other lands where scientific work, no matter in what department, is valued in a due degree. All this must be changed before much progress can be made. No doubt a giant of genius would ignore all obstacles and pursue his work regardless of recognition; but such giants are not to be looked for many

times in a century. It should be made possible for a man of fair abilities to receive as much opportunity, encouragement, recognition, and reward for good work in geography as for good work, let us say, in chemistry or electricity. That is all that can reasonably be asked, and that is what is freely accorded in other countries where the status of the man of science is higher than it is with us. It is here that help may be hoped for from the Scottish universities in the strength of their new endowments. If a Chair of Geography were instituted with the purpose of promoting research first and teaching afterwards, properly equipped with books, maps, and apparatus, and held on the understanding that no outside work was to be undertaken, something might yet be done to restore our country to the position it held a century and a half ago, when a text-book of geography was published without a thought of sarcasm, containing a frontispiece representing "Britannia instructing Europe, Asia, Africa, and America in the Science of Geography."

ON THE CONGO: THE BELGIAN SCIENTIFIC EXPEDITION TO KA-TANGA.

Communication made by Captain CHARLES LEMAIRE, of the 2nd Regiment of Belgian Artillery, head of the Expedition, to the Geographical Section of the British Association for the Advancement of the Sciences.

BY inviting us to present a communication relating to the Belgian Scientific Expedition to Ka-Tanga, the Geographical Section of the British Association for the Advancement of Science has done us a great honour. This honour we cannot accept for ourselves; we transfer it altogether to the work carried out in Africa by Belgium and by the King of the Belgians.

I say we cannot accept this honour for ourselves, for we know too well what we have done has been an easy thing to do, and one of such absorbing interest that the work itself has sufficiently rewarded our exertions. In giving all honour to the African work of King Leopold II., we have to regret that we were not more fully qualified to produce by our labours all that one is entitled to expect from explorers so fully equipped, and whose field of investigation was so entirely virgin soil that they could not fail to return with full hands.

I will with your permission give you a rapid summary of the objects of the Belgian Scientific Expedition to Ka-Tanga, so that you may be able to judge of the exact value of its results.

It would be out of place in this learned assembly to dwell on the part which the science should play in the direction of human activity; I will only say that any explorer who would pretend to scientific rank must relate all that he has observed without the least consideration of public or private affairs. He has been given not an object to be attained,

CAPTAIN CHARLES LEMAIRE

but a subject to be investigated; and these two principles are essentially different.

The explorer, as I understand, must not consider whether private individuals, few or many, may be enriched or ruined by the speculative operations which they are likely to undertake in consequence of the information given to the public by his means. He is purely a student, who is interested only in seeing his discoveries sifted by the largest possible number of tests. "*Testis unus, testis nullus*" is a saying which should ever be in his mind.

It is from this point of view, without exception, that I have worked during my African career, which dates from the end of the year 1889; and when in the end of 1897 the Government of the Congo Free State intrusted me with the organisation of an exploring expedition in its southern territories, I accepted their commission with the sole desire of contributing to science, or, in other words, of serving truth.

With a breadth of view which I cannot sufficiently praise, every facility was given me by the Government of the Congo Free State, both in the arrangement of the European *personnel*, and in the procuring of the various equipment and of the quantity of supplies required for our enterprise. I shall not here reproduce the text of the instructions which I received; they are set forth fully in the *Bulletin of the Society of Commercial Geography of Paris* (1901, Nos. 6, 7, and 8). It will suffice that I should enumerate our scientific apparatus and name the white members of our Expedition, in order that you may see what was expected of us.

Scientific Apparatus of the Expedition.

Latitude, Longitude, Altitude, Cartography.—A meridian circle by Secretan, with nine wires, for taking the six stellar magnitudes: a theodolite by Hurliman, with additional portion for the observation of magnetic declination; two ship's chronometers (sidereal time) by the firm of Hohwü of Amsterdam; a demi-chronometer, sidereal time; a demi-chronometer, mean time; a mercurial barometer, on Captain George's system; a Regnault hypsometer, modified by Fuess; two compensated aneroids, registering up to 3500 metres; two pocket compasses for rapid surveys; two pedometers; three metrical lines; a declinometer and an alidade, for the orientation of the pillar of the meridian circle; a set of staves and two sights; a pair of long-distance binoculars. Our books were the *Connaissance des Temps*, the *Astronomisches Jahrbuch*, and the *Nautical Almanac* for 1898, 1899, and 1900; J. Dupuis' *Table of Logarithms*, after Callet, Vega, etc.; the excellent English handbook, *Hints to Travellers*; besides a number of other works.

Magnetism.—The magnetometer of Captain Delporte, allowing for the determination of the three magnetic components.

Meteorology.—A barograph and a thermograph by Richard; two maximum thermometers, by Negretti and Zambra; three minimum thermometers, by Rutherford; two ordinary thermometers; two slung

thermometers; an August psychrometer; a small Robinson anemometer; an Arago actinometer (with connected bulbs); a Bellani ether actinometer; a solar register; two rain-gauges, with graduated scales; a nephoscope, or mirror for observing the clouds; and a Pinche evaporometer. Also the following books:—*The International Atlas of the Clouds*; Angot's *Meteorological Instructions*, and those of Lancaster, Vincent, etc. The meteorological instruments were supplied and tested by the Royal Observatory of Belgium.

Anthropology.—A pair of sliding compasses; a pair of calipers; a median oblique facial goniometer; an indicator for this goniometer; and Broca's *Anthropological Instructions.*

Geology.—A sight-vane goniometer with a compass; an Assman aspiration psychrometer, with accessories for travel in tropical regions; three porcelain loxodromic tables; three straight-edged mineral chisels; three pointed ones; two earth thermometers; a mercurial barometer by Hellmann; one of Bohne's aneroids; an horizon telescope; a sounding line of twelve metres; a case of reagents and a blowpipe for elementary analysis.

Botany.—Three cases of material for an herbarium, arranged by the care of the Botanical Garden at Brussels.

Zoology.—Six cases containing:—four frames for butterfly nets and for fishing nets; six butterfly nets; eight fishing nets; an insect box; nineteen cans of arsenical soap; three cans of alum; fourteen knives; twelve scalpels; two pairs of scissors; four pairs of forceps; two skinning knives; twelve needles; two boxes of cyanide; nine bottles and three cans of formalin; six screw-top bottles; two spring bottles; twenty-two packets of cotton wool; six kilos. of tow; four kilos. of plaster; five kilos. of naphthaline; a can of varnish; a bottle of methyl alcohol; a ball of twine; six camel-hair brushes; a pair of trimming sheers; a clap-net for catching insects; three quires of paper for butterflies and birds. Also the following books:—*Guide du Chercheur d'Insects*; *Guide du Naturaliste*; *The Sportsman's Handbook.*

Photography.—A camera 18 24, with stand; six double dark slides, with dividers; a Steinhel lens for portraits; a Dallmeyer landscape lens; a Derogy wide-angle lens; a lens for very near objects; two Constant shutters; two metres of india-rubber tubing; two bulbs and twelve inflators for shutters; two lens boards; a softener; a dark lantern, with interchangeable glasses (red, yellow, and white); two ground-glass focussing screens for the camera; materials for making ten litres of toning and developing solutions; materials for making twenty litres of fixing solution; two dishes 18/24; two 13/18; two 24/30; two grooved dishes; two graduated measures of 100 grammes; a sprinkling tap; two plate racks; a diamond; five dozen plates 18/24; twenty dozen 13/18; twenty dozen 9/12; 240 films 9/12; 240 13/18; 240 sheets of printing paper 9/12; 240 13/18; 120 18/24; a printing-frame 18/24; one 9/12; a jointed tripod; two kilos. of paraffin.

Painting and Drawing.—One of Commandant Blain's cameras; three cases each containing:—a mahogany panel, 96 centimetres by 45; two sets of English brushes; two sets of camel-hair brushes; two boxes

with twenty-four of Rowney's large pans of paint; six kilos. of oil-paints; a bottle of Chinese ink; a box of pens; a dozen penholders: four dozen marquise pencils; four dozen Gilbert pencils; a ground glass; a mortar; a box of drawing pins: a bottle of body colour; a notebook for sketches; twenty sheets of Whatman's drawing-paper; twenty canvasses, 98 centimetres by 48.

Prospecting.—Spades, picks, crowbars, mortar and pestle, basins, sieves, bags for specimens, a field forge, etc.

This material—of which the detailed enumeration may prove of use to some traveller intrusted with the preparation of a scientific expedition—indicates sufficiently the character of our Expedition, which is further shown by the composition of its European *personnel*.

This was made up as follows:—

An officer of the artillery, leader of the Expedition; a geologist, doctor of science, second in command; an officer, head of the caravan; an assistant, who had charge of the photographical work, and of the preparation of zoological collections; an artist; a prospector (from the Transvaal); and an under officer, head of the escort.

Of these seven Europeans, six were Belgians, the seventh was an Englishman; this was the deeply regretted William Caisley, whom we picked up at Chinde on our arrival there.

I should like to relate at this point under what tragic circumstances William Caisley lost his life.

When I left Europe I had said to myself that we must expect that not all of us would return, and I had supposed that perhaps two might succumb under our task. Events, alas, fulfilled my anticipations too early.

From the mouth of the Zambezi, as far as the south of Lake Tanganyika, we had been transported by the powerful African Lakes Corporation, Limited. I am glad to give public testimony as to how the head officials of that company, and many of its subordinate agents, understand their work in Africa; as regards the Ka-Tanga Expedition, the transport of our 1000 loads and of the six white men was done so regularly, rapidly, and perfectly, that not a single package was damaged or lost; and when, later on, I intrusted to this same company the transport of our cases of specimens to Europe, I was glad to find the same attention and the same certainty in transport, for all our cases arrived in Brussels in excellent condition. To return, when we had reached Ki-Touta, a station situated at the south of Tanganyika, I made a change in my arrangements: heretofore I had maintained, after Chinde, the place of rear-guard; but since Ki-Touta was the terminal point of our journey on British territory, and since the age of the moon demanded my immediate arrival at Moliro (the first station of the Congo Free State on the Tanganyika), I decided to leave J. de Windt, our geologist and second in command, as rear-guard at Ki-Touta. He was to see about the removal of our packages; and I naturally left with him our prospector, Mr. William Caisley.

With the other Europeans of the Expedition I set off, and in the early days of August 1898 we entered the station of Moliro, where our real work was to begin.

A few days later our friends who had been left in the rear started from Ki-Touta in canoes. During the night of the 9th to 10th August they were overtaken by a violent tempest; their canoe capsized only 150 yards from the shore at Moliro; and on the next morning we found among the rocks the bruised bodies of our unfortunate companions, with whom six boatmen had been drowned. Thus, even before we had begun our work, we were overtaken by inexorable death.

I need not dwell on the profound depression and melancholy which followed this shock. I believe that not even relatives could have suffered such overwhelming affliction as fell upon us. Yet it was our duty to recover ourselves, and that as quickly as might be, for who should say when the next sorrow would be upon us? The future was not in our hands; and it is with the words, *Hodie tibi, cras mihi*, the contrary to those of the pious epitaph, that strength may be regained and courage may return.

For in this great work of Africa we must look chiefly, not upon the element of conquest, and of rapine, and of cupidity; we must, if there be anything of the soldier in us, anything of the missionary, or any touch of the scientific spirit—we must look to that work of redemption and of sacrifice which the white man may achieve for the sake of a continent through which, throughout immemorial ages of slavery and oppression, so many rivers of blood have flowed—rivers which men have taken to be part of nature—to be guided into this channel or into that, without scruple of their source in human hearts. Let us give honour, before all people, to those young men of much knowledge and of no self-interest who have been and will continue to be the leaders in the development of the vast resources of Africa; let us honour them so that there may still be found men capable of high enterprise, without hope of further recompense than the happiness of having served those who are weaker than themselves; for it is a great thing to serve the little just as it is a small thing to serve the great.

When we had laid the remains of our two friends in African soil, I took the necessary steps to inform the Congo Government at Brussels: an express courier was sent with a cipher despatch to the Nyassa, where the telegraph, which has now reached Tanganyika, was in operation. Three and a half months after our misfortune the two places were filled by Messrs. Kemper-Voss and Louis Questiaux, engineer-geologist and prospector respectively, both of whom came from the Transvaal.

Questiaux is a Belgian who had lived in South Africa for five years and a half. Kemper-Voss was born in Natal, of English parentage; he began his studies at the Cape and finished them in London; he was at the Johannesburg mines when the Belgian consul engaged him for the Scientific Expedition of Ka-Tanga. After having made a voluminous report upon the geology of the territories we traversed, he took service again in Africa, and is at present superintendent engineer to the Claudes Ashanti Gold Fields, Limited.

During his stay in Belgium Kemper-Voss spoke before the English section of the Cercle Polyglotte of Brussels. Let me quote some of his words: "When I left the Transvaal," he said, "the Belgians were there

accused of innumerable cruelties. And I expected to find them, at their stations, occupied all day in cutting off the arms, the heads, and the legs of the negroes without ever putting them together again. Now, I have travelled with Belgian officers for a year and a half, and, somewhat to my surprise, I failed to observe any of those things that I had dreaded. Moreover, in our party, so far from finding too much severity, I found myself forced to administer justice. The Belgians are a small people in Europe, but they are of high value in Central Africa; and I am glad to have had the opportunity of making many friends among them."

I have named the scientific apparatus put at the disposal of the members of the Expedition to Ka-Tanga. The following is a short statement of the work that was accomplished with this material.

Cartographic Work.

The laying down on large scale of an itinerary of 6000 kilometres by land and of 600 kilometres by water. The laying down of 16 geodetic plane-table surveys at a scale of 1 : 1,000,000, on which are presented 195 stations determined for the most part by the meridian circle; 265 evenings were occupied in observations for the determination of these stations, among which 16 have been fixed in absolute longitude by repeated lunar culminations.

Since our return the map of our itinerary has been issued on two sheets at 1 : 1,000,000, printed in four colours; these two sheets have been presented to your Association.

Besides this a manuscript atlas is in preparation, giving, on a large scale, the itinerary of each day, with all information relating to topographical and other conditions, such as, to ethnography, mineralogy, fauna, flora, etc.

This atlas will consist of not less than 200 sheets: 100 are completed; the rest will be ready before the end of the year.

Finally, our astronomic, magnetic, and altimetric observations have been made the subject of fifteen memoirs, which I have had the honour to offer to the British Association.

Terrestrial Magnetism.

You are aware how few magnetic observations have as yet been made in intertropical Africa, although so many researches have been carried out in Polar regions. The Equatorial regions do not, however, merit less attention. In a letter addressed to Lord Minto, thanking the British Government for its interest in the science of magnetism, Humboldt expresses himself in these terms:—"It is already nearly thirty years since I stated in my *Collection of Astronomical Observations* how very valuable it would be for physical science if a number of vessels, furnished with the best instruments, should simultaneously cross the Magnetic Equator and the lines without declination, in order to fix at the same moment, in the vast oceanic basin, the declination, the incli-

nation, and the intensity of the magnetic forces. . . ."—(Extract from the Report of the Committee of Physics including Meteorology, April 1840.)

It is clear that Equatorial observations would be of more use on the land than on the sea, because of the stability afforded to the instruments, and the greater facility in avoiding local deviations. The region most favourable for such observations seems to be Central Africa, through which the Magnetic Equator passes for more than 20 of longitude. This portion of the globe has hitherto been almost bare of any such observations; but mention must be made of the magnificent work carried on, from 1837 to 1853, in Abyssinia, by the brothers Antoine and Armand d'Abbadie, as well as of the observations begun by Delporte and Gillis, in 1890-91, along the Congo as far as the Stanley Falls. The Scientific Expedition of which we have had the charge has in its turn fixed 117 magnetic stations, by the three components of declination, inclination, and horizontal intensity.

For two of our magnetic observation posts — Stanley-Ville and Leopold-Ville—we possess moreover the *data* collected ten years ago by Delporte and Gillis. By comparing them with our own we have obtained as the annual component of the secular variation at Stanley-Ville, 7′17″, and at Leopold-Ville, 6′55″.

The mean of these results approaches very closely to 7′. According to the observations made at St. Paul de Loanda (Portuguese Congo) from 1881 to 1888 the secular variation of the declination was estimated at a mean of 5′ per annum.

By taking into account the determinations of 1881 at Loanda, and of 1890 to 1900 at Leopold-Ville and Stanley-Ville, we obtain, for the period 1881-1900, that is to say, for a period of twenty years, a mean of 6′ for the secular variation.

At Brussels, for the same period of time, the variation has been 6′14″.

The concordance of these values is worthy of remark, because it emphasises the observation that the distribution of magnetism in the region of the Congo near the Atlantic Ocean is very nearly the same as that in Western Europe.

I will conclude by noting here that the results of our magnetic observations have been published in the *Bulletins of the Royal Academy of Belgium* (Class of Science), No. 2 (Feb.) 1901. They are also to be found in the first of the fifteen memoirs of which I have already spoken; the proof of these results is given in the memoirs, 2 to 15.

Altimetry.

The determinations of altitude in the course of a journey such as ours can only be approximate; they can, in fact, only be obtained by the use of the aneroid, of the hypsometer, and of the mercurial barometer; one cannot think of making geodetic or geometric levellings. Aneroids have one great advantage: their method of employment is within the

reach of any one; this advantage is however—in my opinion—entirely counteracted by the great tendency of instruments to alter their state of equilibrium. Of course I am placing myself at the point of view of the African traveller, whose aneroids are carried in a sling. If such an one cannot often compare his aneroid with a good mercurial barometer, or, at least, if he cannot find on his route points of which the absolute altitude is well known, it becomes dangerous to trust to the indications of an aneroid. The hypsometer, really more dependable, is comparatively easy to use, but it is not easy to make with it a series of readings at regular intervals, in order, for example, to determine a daily mean. It must further be remembered that the verification of the zero is impossible for the African traveller.

For these reasons, the actual instrument which we used for the determinations of altitudes within tropical regions which have not yet been occupied by civilisation, is the mercurial barometer, which admits of the application of the formula of the Marquis de la Place, in one or other of the forms which have been given it in France, England, or Germany. This formula gives, not absolute altitudes, but the differences in altitude between two stations for which the barometric pressure and the temperature are known at the same time.

It should be remarked at this point, that according to Monsieur Caspari, hydrographic engineer to the French navy, the results of barometric levelling are only of value when the two stations compared are not very distant from one another.

The formula of la Place essentially depends upon the consideration of a vertical column of air, in which one fixes two points at different elevations, and the difference of elevation of these two points is then approximately furnished by the formula.

But these conditions are very far from being realised in the determinations of altitude by the barometer for the stages of an itinerary across Africa such as ours.

To get a clear idea of the position, let us suppose ourselves to be with an explorer who has arrived at Lake Tanganyika, at Lake Moero, at Lake Di-Lolo, at de Gerlache peak on the Congo-Zambezi divide, at the sources of the Congo, and similar positions.

In order that he should apply the formula of la Place, it is not enough for him to know the barometric pressure, the temperature, and the hygrometric state of the air at the place in question; he must also know, for the same time, the same conditions at another point for which the absolute altitude is already known.

In the case which we are considering this other point of comparison must evidently be chosen on the sea-coast, whether on the Atlantic or Indian Ocean, and, as far as possible, in the same latitude as that of the point for which the altitude is sought to be determined.

Even if all this be accomplished, the conditions for which the formula of la Place has been established have not as yet been fully realised, in respect that the two points compared will not be in the same vertical line; they will not even be—as M. Caspari requires—only slightly distant horizontally from one another. If, therefore, the barometric and

thermometric readings were made at the same instant at the two stations, it is plain that one would not be justified in considering these readings comparable, because the local time would vary with the difference of longitude, and because the barometric tide, especially in the tropics, is of an almost absolutely hourly regularity. Thus, if one should read the barometer at Daar-es-Salam, at true noon at this station, and if at the same moment one should read the barometer at Lake Di-Lolo, which is more than 15° of longitude west of Daar-es-Salam, one would have to allow for the fact that the reading at Di-Lolo would be made more than an hour before true noon at the latter place. In these conditions the barometer at Di-Lolo would almost certainly be above its daily mean, which it reaches between twelve and thirteen o'clock; so that at Daar-es-Salam the barometer would be very nearly at the daily mean, while at Lake Di-Lolo it would be distant from that mean by an amount which, though not great, must be taken into consideration when one wishes to determine what limits of approximation one may hope to establish.

The above argument, which is unfavourable to the employment of barometric levelling in a voyage of discovery in the heart of Africa, may fortunately be counteracted by a series of observations which appear to me sufficiently interesting to be noted here. For the traveller with whom we have in imagination associated ourselves, there really arises the possibility of applying the formula of la Place with satisfactory approximation.

This is indeed a fortunate result, for it certainly implies that the traveller can determine, on the very spot, the characteristics of the country he is mapping out; and just as it is advantageous that he should fix at once the latitude and longitude of his positions, so also is it of the first importance that he should be able to determine the altitude.

It must be carefully noted that our traveller has, as his data, only a reading of the barometer and of the thermometer at the place at which he arrives; he is not, and he cannot be in touch with any point of observation established on the sea-coast in the neighbourhood of the Equator.

Having thus stated the problem clearly, let us suppose for a moment that, in the Equatorial regions, the barometer and the thermometer afford, at a given point, readings which are always constant, always invariable.

The whole question will be changed; for now the traveller will have at his disposal the barometric pressure and the temperature for a certain point at the coast, these *data* having been fixed once and for all; he may even have ascertained these *data* for himself before proceeding into the interior.

But barometric pressure and temperature are not invariable.

Only, and it is to this point that I wish to direct your attention, barometric pressure only varies within restricted limits; and while the variations of temperature have a less considerable influence than those of the barometer in the employment of la Place's formula, the mean

temperature also varies within restricted limits in the African Equatorial region.

Allow me to develop this subject further.

From the 1st December 1889 to the 16th May 1891, Dr. E. Etienne made at Banane, at 6° below the Equator, a continuous series of meteorological observations, of which the results are the subjects of Publication No. 7 of the Congo Free State, under the title *The Climate of Banane in 1890*, followed by the meteorological observations made from 1st December 1889 to 16th May 1891.

These observations establish:—

(1) That barometric pressure attains its maximum about 9 o'clock, and diminishes until about 16 o'clock when it reaches its minimum, and then rises again slowly.

(2) That the true mean of diurnal barometric variation was, for 1890, equal to 2 mm., 88; the highest amplitude was 4 mm., 5 (on January 8 and on February 16); the least was 1 mm., 3 (on June 13).

In the second place, continuous barographic observations were made at Daar-es-Salam (in 6° 49′ S. latitude) from December 1895 to September 1899; these observations, arranged by Dr. Hans Maurer, have just appeared in the *Deutsche Ueberseeische Meteorologische Beobachtungen*.

They suggest the same considerations as do those at Banane, as regards the movements of the barometric tide and the slight amplitudes of the diurnal barometric variation.

In the third place, we have brought back, as the result of our investigations in the south of the Congo State, six weekly barographic sheets obtained at Moliro (Lake Tanganyika, in 8° 14′ S. latitude), 10 similar sheets obtained at M'pwéto (on the north shore of Lake Moéro, in 8° 29′ S. latitude), 35 similar sheets obtained at Lofoï (in the valley of the Lou-Fira, in 10° 12′ S. latitude), and, finally, 9 similar sheets obtained at Lou-Kafou (in the same valley, in 10° 31′ S. latitude).

Our barograph was controlled by a mercurial barometer (Captain George's).

Each of these weekly sheets, without exception, gives rise to the following remarks:—At noon, the pressure is mean; then it diminishes by 1·5 mm. to 2 mm. till 16 o'clock; remains nearly stationary until about 4 o'clock, and then rises by about 2 mm. till 9 o'clock, and descends at last to the mean about noon.

The observations at Banane, in Ka-Tanga and at Daar-es-Salam, establish an almost absolute parallelism between the diurnal barometric tides at these three places; at these three places, in other words, the barometer rises at the same local time, descends at the same local time, reaches its maximum, its minimum, and its mean at the same local time, and, lastly, has almost exactly the same range of diurnal variation.

A second important fact is that this parallelism of the diurnal barometric tide is reproduced very nearly exactly in the monthly barometric tide, and therefore also in the annual barometric tide; that is to say, the monthly barometric means vary everywhere in the same direction, and with amplitudes which are identical and very slight.

These conclusions are sufficiently shown in the following tables. Let us first compare a series of stations for which we possess barometric observations for a period of at least a year.

Month.	BANANE. Latitude, −6°. Longitude, 13° 31′ E.G. Altitude, 5 metres.		DAAR-ES-SALAM. Latitude, −6° 49′. Longitude, 39° 19′ E.G. Altitude, 13m,50 metres.		KWAI (WEST OUSAMBARA). Latitude, −4° 45′. Longitude, 38° 18′ E.G. Altitude, 1610 metres.	
	Mean monthly barometric pressures. b_m	$b_a - b_m$	Mean monthly barometric pressures. b_m	$b_a - b_m$	Mean monthly barometric pressures. b_m	$b_a - b_m$
	mm.	mm.	mm.	mm.	mm.	mm.
Jan.	759,06	+1,66	759,02	+1,92	629,60	+0,94
Feb.	758,32 (min.)	+2,40	758,68 (min.)	+2,26	628,95	+1,59
Mar.	758,78	+1,94	759,04	+1,90	628,87 (min.)	+1,67
April	759,58	+1,14	759,65	+1,29	629,11	+1,43
May	760,60 (mean)	+0,12	760,21 (mean)	+0,73	630,86 (mean)	−0,32
June	762,79	−2,07	763,09	−2,15	631,63	−1,09
July	763,64 (max.)	−2,92	763,75	−2,81	632,09	−1,55
Aug.	762,83	−2,11	763,85 (max.)	−2,91	632,37 (max.)	−1,83
Sept.	762,17	−1,45	762,57	−1,63	631,65	−1,21
Oct.	761,11 (mean)	−0,39	761,54 (mean)	−0,60	630,99 (mean)	−0,45
Nov.	759,76	+0,96	759,70	+1,24	629,94	+0,60
Dec.	760,00	+0,72	759,22	+1,72	629,74	+0,80
Mean annual pressure b_a	mm. 760,72 from Dec. 1, 1889, to May 16, 1891.		mm. 760,94 from Jan. 1, 1896, to Sept. 30, 1899.		mm. 630,54 from Mar. 1, 1897, to Nov. 30, 1899.	

This first comparative table sufficiently demonstrates the above mentioned parallelism of the monthly and annual barometric tide: the maximum and the minimum are reached within a month, at the same times of the year; the means are reached exactly at the same months of the year; finally, the discrepancies between the mean annual barometric pressure b_a, and the mean monthly pressure b_m, are in the same direction, and are of values which are obviously identical.

Let us now examine a second table in which I have the advantage of being able to give the observations taken by the Scientific Expedition to Ka-Tanga at the station of Lofoï: these observations, unfortunately, do not cover an entire year, but only eight months; we shall therefore alter the table of comparison, drawing it up only for these eight months, for the stations of Banane, Lofoï, Kwai, and Daar-es-Salam.

Month.	BANANE. Mean monthly barometric pressures. b_m	$b_M - b_m$	LOFOÏ STATION. Latitude, - 10° 12. Longitude, 27° 25' E.G. Altitude, 936 metres. Mean monthly barometric pressures. b_m	$b_M - b_m$	KWAI. (West Ousambara). Mean monthly barometric pressures. b_m	$b_M - b_m$	DAAR-ES-SALAM Mean monthly barometric pressures. b_m	$b_M - b_m$
	mm	mm.	mm.	mm.	mm.	mm.	mm.	mm.
March	758,78	+2,66	684,50	+1,48	628,87	+2,09	759,04	+2,67
April	759,58	+1,86	685,60	+0,38	629,11	+1,85	759,65	+2,06
May	760.60	+0,84	687,40	-1,42	630.86	+0,10	760,21	+1,50
June	762.79	-1,35	687,60 (max.)	-1,62	631.63	-0,67	763,09	+1,38
July	763,64 (max.)	2.20	686,50	-0,52	632,09	-1,13	763,75	-2,04
August	762.83	-1,39	686,30	-0,32	632,37 (max.)	-1,41	763,85 (max.)	-2,14
Sept.	762.17	-0,73	685,50	+0,48	631,75	-0,79	762,57	-0,86
October	761,11	+0,33	684,40	+1,58	630,99	-0,03	761,54	+0,17
Mean Pressure for 8 months b_M	mm. 761.44		mm. 685,98		mm. 630,96		mm. 761,71	

An examination of this second table leads to the following conclusions:—

(1) The barometric pressure rises from March to June at Lofoï, to July at Banane, to August at Kwai and at Daar-es-Salam, to fall thereafter to October; at Kwai and at Daar-es-Salam we may consider that the maximum is already attained in the month of July, for the pressure of July at those places is equal to that of August less 0·3 mm. and 0·1 mm. This well shows the above-mentioned closely approximate parallelism of the barometric tide.

(2) The discrepancies $b_M - b_m$, that is to say, between the general mean of the eight months and the monthly means, are obviously in the same direction and of slight comparable value.

(3) These same discrepancies are included within somewhat narrower limits for the station of Lofoï and that of Kwai, which are in the interior, than for Banane and Daar-es-Salam, which are on the coast.

All the above remarks may be summed up as follows:—

For the African Equatorial belt the mean barometric pressure varies within very narrow limits; the diurnal tide occurs everywhere in the same direction and with the same slight amplitudes; and the same rule evidently holds in the case of the monthly and annual barometric tide.

Thanks to the existence of this phenomenon, it becomes possible to make use of the formula of la Place in the determination of real altitudes, by taking, as our *surface of comparison*, a surface approaching as closely as possible to the level of the sea in the neighbourhood of the Equator. This sea-level is certainly not very easy to determine; but the surface of comparison to which we shall refer our altitudes may, without objection,

differ from the true surface of the sea; for, as I think, the barometric method may not pretend, in a case such as we are at present considering, to a closer approximation than one of twenty metres more or less. This surface of comparison will be distinguished: (1) by a mean barometric pressure equal to the mean of the annual means observed at Banane and at Daar-es-Salam; and (2) by a mean temperature equal to 25° 50′, a figure supplied both by the observations at Banane and by those at Daar-es-Salam.

Having established this, let us consider the formula of la Place under the form which has been given to it by Monsieur Mathieu:—

$$\triangle = \begin{cases} \left[18336^{m} \log \frac{H}{h} - 1^{m},2843\,(T-T') \right] x. \\ x \left(1 + \frac{t+t'}{500} \right) \times \left(1 + 0.00265 \cos 2\phi + \frac{\triangle + 15926}{6336198} \right) x. \\ x \left(1 + \frac{S}{3183099} \right). \end{cases}$$

In this formula ϕ represents the difference of altitude between two stations characterised as follows:—

$$\text{Lower Station} = \begin{cases} H = \text{height of barometer.} \\ T = \text{temperature of barometer.} \\ t = \text{temperature of air.} \end{cases}$$

$$\text{Higher Station} = \begin{cases} h = \text{height of barometer.} \\ T' = \text{temperature of barometer.} \\ t' = \text{temperature of air.} \end{cases}$$

Further, ϕ is the mean latitude between the two stations, and S the height of the lower station above sea-level.

In this formula we shall make $H = 761{\cdot}62$ mm. (average of the annual mean pressures at Banane and at Daar-es-Salam, reduced to temperature 0° and to the level of the sea); $T = 0$; $t = 25{\cdot}5°$.

Suppose, further, that at the point where the barometer is read, it is arranged that the temperature of the barometer shall be equal to that of the atmosphere outside; or, in other words, that $T' = t'$.

Finally, ϕ can be made to $= 0$, the latitude of the place having only a very slight influence within the Equatorial belt with which we are concerned.

Starting from these *data* we are enabled to calculate a single table for the determination of altitudes, by a single reading of the barometer and of the thermometer at one station in the interior of Africa. We should make h vary between 761·62 mm. and 600 mm., and t′ between 10 and 35 . We should thus be certain to find ourselves within the limits of temperature and of pressure for the greater part of Equatorial Africa; places of which the altitude reaches or exceeds 2400 metres being naturally excluded.

A table of this sort was made twelve years ago by the late Belgian, Captain Delporte, who died on the Congo during the first scientific expedition intrusted with astronomic determinations.

Delporte, however, took as his surface of comparison one having a

mean barometric height of 758 mm., this height of mercury being reduced to the temperature of 0° : he took 26° as mean temperature; and thirdly, his calculations only had reference to pressures varying from 760 mm. to 675 mm., and to temperatures between 20° and 35°.

At the period when Delporte calculated his table it was from these different *data* that one had to work.

Meteorological observations made since 1889, as well as the numerous expeditions which have overrun and discovered Central Africa, lead us to substitute for Delporte's *data* those which we have just proposed. It is by means of Delporte's table that we calculated, while in Africa, those altitudes which appear in the first of our memoirs relating to our various observations.

We thus obtained for the absolute altitude of Lake Tanganyika the figure 777 metres, considerably less than the figures obtained previously. Livingstone gives 800 m., Stanley 840, Cameron 826, Popelin 812, Wissman 814, Thomson 798, Stairs 818, Baumann 811.

Our attention was soon drawn by von Dankelmann, the learned German meteorologist, to the observations made at Daar-es-Salam at the very time when we were conducting observations at Lake Tanganyika.

Thanks to these simultaneous observations I was able to repeat the determinations of the altitudes of the various stations of our itinerary; in particular the altitude of Tanganyika was fixed by 222 observations of the barometer and the thermometer made simultaneously at Daar-es-Salam and at Tanganyika; the calculations were made with the valuable assistance of M. Lancaster, the learned director of the meteorological department at the Royal Observatory of Uccle. The tables employed by M. Lancaster on the one hand, and by myself on the other, were those of Jordan, of Angot, and of Mathieu; I applied also directly the formula of Babinet, as also the formula of Bauernfeind.

The uniform results of these long calculations fix the absolute altitude of Tanganyika at 854 metres.

If it is desired to apply Delporte's table, in view of the conclusions at which we have already arrived with regard to the parallelism of the barometric tide, the following method should be adopted:—

Our barometric and thermometric observations at Tanganyika were made in August and September 1898, and gave, as mean barometric pressure at the level of the lake, 695·6 mm. (not reduced to zero), and a temperature of 23°.

Well, in the months of August and September, the barometric tide is higher than its mean annual value, by an amount that we can fix very approximately by examining the table of monthly means at Banane and at Daar-es-Salam.

Thus at Banane the mean for August-September is 762·5 mm., that is to say, higher by 1·78 mm. than the annual mean; at Daar-es-Salam, the mean for August-September is 763·21 mm., that is to say, higher than the annual mean by 2·27 mm.

We will take 1/2 (1·78 mm. + 2·27 mm.) = 2 mm., for the amount by which the August-September mean exceeds the annual mean.

We then have for mean annual barometric pressure at the level of Tanganyika 695·6 mm. − 2 mm. = 693·6 mm.

On referring to Delporte's table with the values h = 693·6 mm. and t′ = 23°, the altitude of Tanganyika is found to be 813 metres.

But, as we have said, Delporte took the figure 758 mm. as mean pressure at the sea-coast in the Equatorial regions, although that figure should be 761·62 mm.

Hence it follows that we must raise the altitudes found by Delporte's table by the amount of the difference between 761·62 mm. and 758 mm., that is, 3·62 mm. of the mercurial column, which corresponds to 41 metres of a column of air.

The exact figure, therefore, for the altitude of Tanganyika becomes 813 metres + 41 metres = 854 metres; that is, exactly the figure furnished by the complete application of la Place's formula to the stations at Lake Tanganyika and Daar-es-Salam, for which we knew the simultaneous barometric and thermometric readings.

I should say here that the same concordance is shown in the calculation of the altitude of Lake Moëro and of the station of Lofoi, which are the points at which we took readings of the mercurial barometer.

I think, therefore, that we may justly infer the possibility of calculating a single table of altitudes which may, for the determination of altitudes in Equatorial Africa, supersede the fourfold tables which are at present employed, and which demand the knowledge of the barometer and thermometer at a point of comparison—a knowledge which the African traveller cannot obtain.

The advantage of this single table is that one goes to it with only the immediate barometric and thermometric readings at the place where one happens to be; one does not require to subject these readings to any save instrumental corrections, and one does not reduce to zero temperature nor to the latitude of 45°.

In using such a table, the traveller would, for example, read the barometer at a certain time of day; he would first reduce it to the diurnal mean by aid of his knowledge of the daily movement of the barometric tide, which we have described above; and his best course would be to take the reading at 12.30, which is the time of the daily mean.

Having obtained this daily mean, he would modify it to bring it to the annual mean, which would be done by aid of the tables given above for Banane and Daar-es-Salam.

Having secured the approximate annual mean, he would consult the single table, and obtain the desired altitude with a very satisfactory approximation.

It is obvious that, if our traveller is able to make a series of barometric observations extending over several days, his result will be all the more satisfactory.

I must at this point leave the subject of the determination of altitudes, in the hope of having drawn your attention to an interesting point. If it be asked why I have not myself arranged the table that is to supersede that of Delporte, I can only answer that time fails me to

do so, for I desire urgently to take the road for the fourth time in Africa. This, also, is the reason why I cannot even publish all the documents brought back by our Expedition; I have to content myself with producing those of them which require immediate publication, leaving the others to be taken up when I shall have sufficient leisure.

To conclude this matter of altitudes: I should say that the highest altitudes which we determined were 1900 metres above the level of the sea, those, namely, which occur on the western shore of Lake Tanganyika; the vast plateau of the Kou'n'deloungou includes altitudes of 1750 metres; while on the Congo-Zambezi divide we did not find points higher than 1650 m. above the level of the sea.

Meteorological Observations.

We were able to establish successively four meteorological stations; the first at Moliro (Lake Tanganyika) for six weeks: the second at M'pweto (Lake Moëro) for ten weeks; the third in the valley of the Lou-fira, at Lofoi, for eight months; and the fourth in the same valley at Lou-Kafou, a station which took the place of Lofoi as the head-quarters of the Ka-Tanga zone.

At the last-mentioned station operations were continued after our departure, thanks to the kindness of Captain Verdick and his assistant, Lieutenant Delvaux, who were the Government representatives on our arrival in that district. Unfortunately, on the departure of these two intelligent and zealous officials, the observations were given up; and I have lately learned that a "fine tornado" destroyed the apparatus which we had conveyed from Europe to Ka-Tanga, with such solicitude and at the price of so much anxiety and caution. I could not help remembering that we encountered tornadoes of violence sufficient to uproot trees, and that, in spite of them, we were able to protect our precious instruments. This time a fine tornado has had the best of it. What good fortune for those who should have continued our observations!

It is true, however, that observations which are reported by observers of insufficient weight deserve but one destination—the waste-paper basket.

Whatever may be the nature of the stoppage that has been put to the working of the observatory which we left at Lou-Kafou, we may still congratulate ourselves on having secured, for a period extending from August 1898 to August 1900, *data* relative to the temperature, to atmospheric pressure, to hygrometry, to evaporation, to the duration of insolation, to solar radiation, to atmospheric precipitation, to the nature and direction of the winds and of the clouds, and to the transparency of the atmosphere, etc.

The entire results of these observations are in the hands of M. Lancaster, the scientific director of the meteorological work of the Belgian Observatory; under his supervision we hope soon to be able to publish the memoirs relating to our meteorological observations.

Let me call your attention to certain curious phenomena observed by

us: for example, to the violent hailstorms, preceded and accompanied by literally continuous thunder; and to the sudden, almost instantaneous, falls of temperature, accompanied by rainy tornadoes, and sometimes exceeding 10°; these sudden falls in temperature always affect Europeans with a peculiar and very characteristic discomfort, an extreme depression which made us utterly unfit for any active work during the rest of the day. Another very interesting phenomenon was shown by the thermograph; this consisted of nocturnal risings of temperature, occurring two and even three times in one night, and amounting to 3° or even more; the cause of these nocturnal risings, which were observed regularly for long periods, has yet to be determined. But without asserting that it is so, one may ask if this may not be an element in the condition which makes the nights sometimes insupportable on account of excessive perspiration. And lastly, I would direct your attention to the really low temperatures noticed at high altitudes. For several weeks, at a period when we were at an elevation of about 1200 to 1300 metres above sea-level, the temperature fell every night to about 2° above zero: the evenings, whenever there was a trifling breeze, were so cold, that, even when we were wrapped in overcoats, and as close as we could get to a blazing fire, we found it impossible to stay in the open air, and were obliged to take refuge in some kind of shelter and make a fire there. At this time, every one was a victim to cold and sore throat: the blacks suffered as well as the whites, and not even the dogs were exempt. These low nocturnal temperatures were followed by day temperatures not exceeding 23° to 24°, which were ideally agreeable. With this in mind, one cannot despair of one day seeing a white race attempting to settle on the high plateaux of Ka-Tanga.

Geology.

Messrs. Kemper-Voss and Questiaux have made detailed reports, and have drawn up the maps and geological sections relating to our explorations; more than forty cases of mineralogical specimens were collected, and these specimens have been classified since our return to Brussels. These documents will be found in the Congo Museum of Tervueren, near Brussels, and are in the hands of a permanent commission of geologists.

I do not yet know whether the reports of my colleagues will be published in their original form, or whether they will be used for the drawing up of a work by the commission of which I have just spoken, a work which will take account of the *data* collected by those expeditions which preceded ours.

In the course of our journey hundreds of washings of rock were carried out; but not so much as one disclosed the least trace of precious metals.

Since our return many specimens have been submitted to qualitative and quantitative analysis: the specimens analysed have disclosed iron, copper, and cobalt, but nothing more.

Traces of coal of chemical origin were found, but these are without

importance from the point of view of the existence of "workable beds."

The mineral treasures which have been for a long time so liberally ascribed to Ka-Tanga did not reveal themselves to us.

So far as truth is concerned, the whole region abounds in iron ores, among others in almost pure magnetite, which forms very characteristic peaks in the south of the Congo State, peaks in the vicinity of which the compass becomes quite infatuated; then there is copper, which is found almost exclusively under the form of malachite, impregnating the schists or the cavernous quartzites. The working of this has been from time immemorial carried out by digging pits of 1 to 1·50 metres in diameter and of a similar depth; in some places the malachite rock takes the form of low hills in which the native has hollowed galleries without order or method: moreover, the reduction of the malachite is effected only on a very small scale; still it is possible that the superficial zone exploited by the natives is but the surface of deeper and more important seams of copper pyrites, the exploitation of which is reserved for the future.

Cobalt was found in almost all the specimens which we submitted to analysis, in very varying proportions, reaching from 1 per cent. to 11, 14, 16, and even 23·7 per cent.

As for gold, silver, and mercury, we neither saw nor found any trace of these metals: nor did any of those who preceded us, in spite of all that has been said, often too complacently, on this matter.

I may note further that the native works iron and copper very little, but that certain salts, and in particular the salts of Moachia and of Gânza, are worked to a considerable extent.

Calcareous deposits yielding a good lime are being worked by Europeans, particularly at Tanganyika.

In conclusion, I would indicate shortly that the prevailing rocks are sandstones, schists, limonites, quartzes and quartzites, quartz conglomerates, magnetite, dolomite, and, in some places, granite.

Fauna and Flora.

A hundred plates showing the fauna and flora were drawn and coloured by Messrs. Dardenne and Questiaux; an herbarium was collected by M. Verdick, head of the zone of Ka-Tanga, by means of the material which we gave him; and ten cases containing our zoological collections were sent to Brussels.

All these are in the Colonial Museum at Tervueren, in the hands of two permanent special commissions, the one botanical and the other zoological.

The work of these commissions appears regularly in the magnificent *Annales du Musée du Congo*, published by order of the Secretary of State.

It is greatly to be regretted that the plates which adorn this fine publication cannot be coloured; to learn how much this is to be deplored, it is only necessary to look at the coloured plate accompanying an article written by M. G. A. Boulenger, on the fish collected by us in

Tanganyika (*Transactions of the Zoological Society of London*, vol. xv. part iv. December 1899).

I take this opportunity of informing you that all the ichthyological collections of the Congo Free State have been studied by M. Boulenger, a Belgian settled in London, Fellow of the Royal Society, and of the Zoological Society, etc. etc.

Let me give you a rapid survey from the economic point of view of the fauna of the South Congo State.

Elephants are not numerous; nor are lions, in spite of what has been said and written on this subject. Our long journey was accomplished without our once having seen either of these animals. Big game is confined to definite localities, and many consecutive days of travel have elapsed without our seeing a single antelope. We came across only one buffalo, which was killed near our station at M'Pweto.

On the other hand, we had, on several occasions, the pleasure of seeing herds of zebras galloping past, amounting to as many as twenty-five head, or, as a Portuguese traveller would say, "to a hundred hoofs."

The antelopes are of very various species; they range in size from that of a greyhound to that of a foal. Both zebras and antelopes often contributed to varying our ordinary bill of fare; and from time to time we used the venison in the preparation of "biltong," that is, smoked meat after the Transvaal fashion. I was even able to take back to Brussels strips of this smoked meat, which if the smoking has been successful, remains almost incapable of putrefaction.

The hippopotamus, the wild boar, and the *orycteropus* of the Cape are found in considerable numbers, especially the last named, two specimens of which we sent to the Colonial Museum at Tervueren.

The lakes and the rivers abound in fish; fresh-water oysters, crabs, and leeches are also found in them; the crocodile exists in the lakes and in the larger rivers.

Among wild animals we have the lion (rare, as I said above), the leopard, and the hyæna, and a great variety of wild-cats, black-footed cats, tiger-cats, etc.

Water-birds are very abundant, and some of these are very large, which may explain the fact that certain travellers have reported the existence of the ostrich in Ka-Tanga; most of these birds are eatable. At Lake Di-Lolo, on one morning stage alone, thirty-eight victims were brought back to camp.

Snakes are very numerous, but are nearly all small and harmless.

All kinds of vermin infest the country: ticks, jigger-fleas, fleas, bugs, cockroaches, centipedes, and everywhere and above all the insufferable mosquito and the voracious ant, these last being the real and the only wild animals of Africa. I must also name the tsetse, to which I shall return later, without saying anything bad about it.

I must not omit to notice the wild bee, which yields abundantly an exquisite honey: in order to obtain it, the native hangs on the trees his curious hives, made simply of a strip of bark rolled into a cylinder, over a yard long with a diameter of about a foot, and closed at one end; the bees take quite readily to this primitive abode, and when the honey

harvest is in, the native eats the honey cakes just as he finds them, wax, honey and larvæ, and all, though sometimes he extracts the honey and makes an excellent mead, selling the wax to Portuguese traders from Angola.

I shall further refer to the raising of cattle, but must first allude to the useful plants, which are not very various or abundant in the regions we visited.

The native lives chiefly on grains: there are maize, sorghum, millet, eleusine, beans, and rice in small quantity; then come manioc, sweet potatoes, the yams, earth-nuts, and sesame, pumpkins, various kinds of spinach, etc. Few cultivated fruits are found, though we occasionally met with bananas; on the other hand, there are quantities of wild fruits, among which I may mention the raspberry and the vine.

The bush yields many plants from which the native extracts good oils; that which is obtained from the *chibi* is of a bright red colour; in the villages the castor oil plant and *Jatropha curcas* are cultivated, and their oils are used for toilet purposes. Finally, the culture of tobacco and hemp, and especially of the former, is in a highly advanced condition.

Rubber occurs, but it is not as common as in the central Congo. In the basin of the Upper Kassaï that variety which is called *des herbes* (root rubber) is collected; it is bought on the spot by the "Wa-m'boundous," as the black traders from Portuguese territory are called, who come every year from the coasts of the Atlantic to the great lakes of Central Africa. Unfortunately even yet their most profitable trade is that done in *black ivory*.

Besides these caravans of Wa-m'boundous, who march in columns of eight, ten, and twelve, we were surprised to meet two Portuguese traders; one of them, Oscar Vicente da Silva, was a mulatto from Madeira, the other was a little Lisbon fellow; they were returning from the sources of the Lou-Loua, and had two wagons drawn by twenty bullocks, and loaded with rubber; they had even had to leave behind them eight tons of their valuable cargo, which they hoped to get on another journey.

We also collected different kinds of resin in the course of our journey, as well as specimens of valuable timbers, and of native ropes and basket-work.

I am glad to be able to lay before you the album depicting the fauna and the flora, which we owe to the pencils of Messrs. Dardenne and Questiaux. I do not doubt that you will agree with my regret, which I have already expressed, that we were not able to publish these plates in colours.

Ethnography.

Besides the anthropological measurements made by Captain Verdick, administrator of the Ka-Tanga region, on our behalf, we have collected ten cases filled with various objects: 350 photographs were taken by M. Michel, while M. Dardenne drew, sketched, and painted the various racial types, as well as scenes and landscapes.

The paintings executed by my friend and colleague were publicly

exhibited in Brussels during last June: the catalogue of these works extends to not less than 290 examples, exclusive of the plates of animals and plants.

The many flattering articles which the Press have devoted to the exhibition of this collection lay special stress on the rapid, exact, objective, and permanent impression of the countries we traversed, which may be gained by an examination of these drawings and paintings in oil and water colours.

In this connection I may say that, being naturally anxious to preserve such a collection intact, I have myself acquired it wholly. We are thus assured against the dispersion or loss of these interesting documents.

. . . . . .

Such is my rough account of the attainments of the Scientific Expedition to Ka-Tanga. I should have liked to conclude by adding a few interesting observations; as, for instance, our visit to the legendary caves of Ka-Tanga; the discovery of a prehistoric settlement on the Lou-Boudi; the nature of Lake Di-Lolo, as of a pool without any outlet; the detailed examination of the Congo-Zambezi divide between the 22nd and the 27th degree of longitude east of Greenwich, a region in which we crossed and recrossed this water parting no less than twenty-five times; the determination of the sources of the primordial Congo; and other subjects of our researches; but details on these matters would pass the limits which have been given me for this paper.

I must therefore confine myself to a few rapid observations with regard to *the occupation of these countries by Europeans.*

The question of the possible development of permanent colonisation on the high plateaux of Ka-Tanga has hitherto been problematical; experience alone can decide, and experiment to that end has yet to be made, for, up to the present time, those high plateaux—their altitude reaches 1750 metres in habitable regions, and 1900 at the summit of certain peaks—have not been occupied by Europeans.

The native, who avoids low temperatures, naturally limits himself to the valleys, of which the altitude ranges from 900 to 950 metres; at least, this is the general rule in those regions in which Europeans have established themselves, for, in other places, the native is obliged to inhabit altitudes of even 1450 and 1500 metres, because lower regions are not at his disposal.

Wherever the European is now settled, he requires the services of the native, and so has not attempted to take him up from his low valleys to the higher plateaux; the question of colonisation by a white race is therefore still an open one.

But other really satisfactory experiments have been made with reference to the acclimatisation of stock and of those vegetables which are peculiarly valuable to a European colony. Wheat, the European potato, all our green vegetables, including asparagus, fruits of various sorts, among which I am pleased to notice the strawberry, all these have been introduced with complete success by the admirable White Fathers of Cardinal Lavigerie; and from their splendid mission stations at Tanganyika most of these products have spread to other European

stations. A curious fact is that we found among the natives of Ma-Roungou—a western plateau, south of the Tanganyika—our familiar green pea growing very successfully. It was introduced into the country —so said the old chiefs to whom we spoke—by a "mousoungou" (a European), who came there many years ago; perhaps it was Livingstone himself.

Cattle thrive everywhere; no European station is without their milk, butter, and cheese; hardy saddle and pack donkeys are found at the same places; indeed, in the valley of the Kassai, and along the Congo-Zambezi divide, between the 23rd and 25th degree of longitude east of Greenwich, cattle are found in all the villages; we counted on various occasions herds of forty head belonging to a single village.

That notorious fly, the "tsetse," we found almost everywhere; we were often bitten by it: we picked it off the donkeys, yet the animals suffered not the least. Perhaps the country which we traversed has the good fortune to be free from the sources of infection which the tsetse appears to find in South Africa, and with which it inoculates the animals when it pierces their skin in its search for nutrition; perhaps, too, the venomous powers of this "fearful scourge" have been greatly exaggerated. However that may be, our own observations may be summarised as follows:—

We found, as I have said, the tsetse fly everywhere; it occurred in two varieties. Now, cattle are found at many of the stations and prosper there: at Lou-Kafou, the mission of Moéna (Ka-Tanga), the mission of Loanza, M'Pwéto Ki-Engui (Lake Moéro), Moliro, Baudouin-Ville, M'Pala (Lake Tanganyika), Ka-Songo, Nyangoué, Lokoli, Ponthier-Ville, Stanley-Ville, etc.

It appears then, so far as concerns the territories of the Congo Free State, there is no reason to fear the tsetse fly in the matter of the raising of cattle.

Goats, sheep with fat tails and no wool, pigs, ducks, hens, pigeons, are found in the farmyard of all the European stations: in some are guinea-fowl, antelopes, wild geese, and peccaries in a state of domestication; and in certain stations we even saw crested cranes, pelicans, argils, and other birds.

I was greatly impressed by the White Fathers of Tanganyika. I consider them to be examples to the whole world. Their buildings, their husbandry, and the results they have obtained filled us with astonishment. I do not hesitate to say that our observations were not influenced in the least by the fact that we are unable to associate ourselves with their creed. We were witnesses of an excellent work, and we report it in all sincerity.

To begin with their table, nowhere did we come across so excellent a bill of fare yet; with the exception of the pepper, every dish and condiment was native of the soil. The bread was made from wheat grown in neighbouring fields; there were rice, European potatoes, salads of every kind, including garden and water cress, leeks, cabbages, asparagus, carrots, turnips, celery, radishes, purslain, tomatoes, the egg plant, spinach, parsley, chervil, onions, etc. Of fruits there were bananas, the

papaws, oranges, grenadillos, pomegranates, Cape gooseberries, figs, cinnamon apples, Cayenne cherries, European strawberries—even vines, which gave good promise of an abundant and various crop.

We drank mead and *pombé*—a native beer; and from the latter the good fathers distilled an excellent liqueur, of which we took a glass every evening. Sugar was replaced by honey. Oil is made from the indigenous earth-nut; vinegar is obtained from bananas: salt comes from the salines of N'Gânza.

Besides the ordinary produce of the farmyard, there were fish of exquisite flavour from Tanganyika, the savoury venison of the antelope, wild pig, guinea-fowl, red partridge, pigeons, and other game.

The White Fathers use lard from their pigs instead of butter, and make of them ham, sausages, and black puddings. Antelope venison yields the most excellent smoked fillets. Coffee is grown in the extensive plantations which surround each mission. And the good fellows smoke the tobacco which themselves have grown.

We found them greatly delighted with the country; they all said that if they could only eradicate the fever from which they suffered at times, they would have much preferred the climate of Tanganyika to that of Algeria.

There is also a most interesting family living near the White Fathers of Tanganyika: that, namely, of Captain Joubert, a Breton, chosen by Cardinal Lavigerie as his lieutenant. This man had no sooner assumed the cross than he fell upon the slave-dealing Arabs with so formidable a warfare that he soon purged the country of these banditti. He became the hero of the people whom he had delivered; he took a wife from among them, and is now the father of four fine children, whose education is carried on by the White Fathers with the assistance of the admirable sisters of charity, whose devotion is quite above praise. For, unlike other women whose lot it is to live among savage races, unlike the wives of Protestant missionaries or of Government officials, they have no human relationships through which and for which their fortitude may be maintained. Not wealth nor fame awaits them; yet they pursue their holy calling with all joy, ready for every service and for every sacrifice, being filled with faith and hope and charity.

Thousands of native pupils live contentedly near the White Fathers, hearing, and in some degree following, their instruction.

I must return, briefly, to the present occupation of the country by Europeans. The first steamer which was taken to the Tanganyika was a little Belgian steamer, the *Cambier*, so called from the name of the officer who accomplished its transport; but this launch, being flat-bottomed, was not able for the weather of the lake. You must know that navigation on these African lakes is not altogether easy, and that boats designed for them must be well keeled. So the *Cambier* had to leave Lake Tanganyika, but her engines still work the sawmill of the White Fathers at Beaudouin-Ville.

The second steamer on Tanganyika was the *Good News*, first owned by English missionaries, but later made over to the African Lakes Corporation, Limited. The third was the German steamer *Hedwige von*

Wissman, brought up by Lieutenant Schloeffer; the fourth is the *Tanganyika*, transported and put together by the Belgians.

On the Moéro, when we arrived, there were only three sailing and rowing boats: these were—the schooner *Leopold II.*, belonging to the African Lakes Corporation; the boat belonging to the English mission at Loanza (Congo State); and another belonging to Captain Weatherley Poulett, an English sportsman who has lived for six years by the lake, hunting and making geographical observations.

I believe that there was also at the same time a fourth boat, built of iron like the three others, and belonging to the English station of Rhodesia.

Since we left the Moéro, a steamer, the *Scotia*, has been launched on it by the African Lakes Corporation, and a second, the *Moéro*, by the Belgians.

And so the industrial occupation of Central Africa hurries on apace; and I do not hesitate to say that it is now possible, I will even say easy, to cross Africa from the mouth of the Zambezi to that of the Congo in two and a half months or even less.

In view of the packets now running on the Congo, the Nile, and the Zambezi, one may say that there is no longer any really "remote" station in the centre of Africa; this development, the work of less than a quarter of a century, is rich in instruction and in hope for the future.

All honour to the illustrious names of those first of African explorers —Livingstone, Cameron, Speke, and Stanley. These were the intrepid pioneers of a heroic age; our African travellers of to-day can only hope to be their humble successors. Our work consists in making known, objectively and in detail, a country which is as open now as it was impenetrably sealed only twenty years ago; the chief merit, as I think, of the modern African traveller is that his work should be carried out, absolutely, in peace.

And so I am led to speak of the meeting upon the Congo-Zambezi divide of Major St. Hill Gibbons of the 3rd East Yorkshire Regiment, and the Belgian Scientific Expedition to Ka-Tanga. You are aware that your countryman crossed Africa from the Cape to Cairo simultaneously with our journey from east to west. Our two itineraries were bound to cross; curiously enough, we met at this crossing-point on the 15th November 1899. Both of us at the moment were making for the station of Lou-Kafou, only that Major Gibbons could have reached it as the crow flies, while our work led us to continue the exploration of the Congo-Zambezi water-parting before our return to Lou-Kafou.

Major Gibbons's whole company consisted of three donkeys and four black men; he had just lost two of his beasts by a lion, which then fell to his rifle. I felt great respect for this officer who had undertaken so great an enterprise with so small a following, and I had the pleasure of offering him some of our porters, of whom we had no fewer than 550. I also invited the honour and the pleasure of his company to Lou-Kafou. In spite of the fact that the period of his journey was thus extended by over a month, Major Gibbons fell in with my suggestion, and for six weeks we travelled together. But we were forced to part at Lou-

Kafou, for the Englishman was bound for Moéro, and thence for Tanganyika, on the way to the Upper Nile and Cairo. He had accomplished his journey without firing a shot, and our Expedition can make a similar claim. On looking back over our long route, there is nothing that I like better to remember than this, that we left behind us no cause for complaint nor any ground for ill-will among the native populations.

This great white cross, traced out by Major Gibbons and the Belgian Scientific Expedition to Ka-Tanga, is an irrefutable proof of the possibility of obtaining the assistance of the native peoples without the use of force, and I will go so far as to say that even though we had done nothing further than to have demonstrated the possibility of peaceful travel, our journey would not have been unsuccessful.

And I like, too, to think of the fact that two leaders of scientific expeditions, of different race, can meet on a common field of action, not as enemies, but as friends—as men whose mere business it is to determine fact. We, who were animated by that scientific ideal, welcomed a meeting which was bound to add greatly to the weight of our observations; for Major Gibbons continued his work while we went on with ours; he surveyed his route, as we did, along our common track, and at evening we both took observations of the same stars. You will readily understand with what satisfaction we found that our results were in entire agreement.

And I must add that Major Gibbons, who for six weeks travelled in the company of five Belgians and 550 natives, and afterwards visited eleven Belgian stations, has taken every opportunity on his return to Britain of protesting against the false reports which have been put about with regard to Belgian colonisation. In this matter also our meeting in the centre of Africa promoted a sympathetic understanding, and established a lasting friendship between Major Gibbons and the Belgians of the Congo.

In the course of my journey across Africa I had the pleasure of coming into relation with several British travellers. I have already spoken of my esteem for Mr. Kemper-Voss, our geological engineer; I have spoken also of the officials of the African Lakes Corporation, in connection with which I would specially name Messrs. Gibbs and Runciman; I never recall, without deep feeling, the pleasant days which we passed in the company of Captain Boileau, with whom we travelled from Chinde to the north of the Nyassa; I may also mention Captain Close, head of the Anglo-German Boundary Commission between the Nyassa and the Tanganyika.

And now, gentlemen, that your distinguished Association has welcomed me here, I would thank you very heartily for that honour. It is new evidence of an old experience, that scientific probity and the genuine love of truth rise quite above all questions of international rivalry. For we seek only to extend our common knowledge, and especially our knowledge of this earth—too often the graceless theatre of needless sorrow and of sordid quarrel, but also the arena for most splendid achievements of action and of research. And I do not doubt

that you realise how excellent is your work, and how high is the devotion which it inspires. This at least is certain, that pure scientific truth becomes sooner or later of service to industry, to practical needs, to the uses of life for all time to come. Indeed, the service of truth, untainted by baser motives, is the most worthy effort as it is the most arduous labour of humanity, it is the mark by which noble spirits and higher civilisations are known to one another. And our increasing knowledge throws into strong relief the fact that the co-operation of all is needed for the conquest of the world by those who have so long called themselves its kings but who are still only pretenders to sovereignty.

And, as regards this development of Africa, we cannot fail to know that the secular victory will not fall only to those who can command the most rifles or quick-firing guns, but rather to those who shall have achieved greatness by a more profound realisation of human solidarity. It is too foolish, too unjust, to seek lightly a harvest of wealth and permanent prosperity where for centuries one has sowed terror and death.

Generations too have their solidarity: "*Delicta majorum immeritus lues*"; and the nations of Europe must, in Africa, pay for that crime of their fathers: the murder of a race; and only that justice which expiates will bring with it the prosperity which rewards.

Many of the most burning questions which are pressed upon us to-day by the moral and social condition of the proletariat of the old continent will, we hope, find their normal solution in the realisation of the vast resources of Africa. Charity, let me repeat, charity between peoples and between races, is not less sacred or less fruitful than is the charity between individuals.

I will conclude by thanking you for having permitted me to speak in the name of a country which, though small in area, has, by reason of the character which it has shown in Central Africa, an indefeasible right to the consideration of the greater nations. I do not doubt that Belgium has already won the sympathy of the great British nation, nor that she will know how to keep it in the years that are to come.

CAPTAIN LEMAIRE'S ITINERARY.

THE Katanga Mission left Europe on the 14th of April for the East Coast of Africa. The voyage was made in a vessel of the Deutsche Ost-Afrika Linie to Beira, whence Chinde was reached on board a coasting steamer on the 25th of May. From Chinde they proceeded up the Zambezi and Shire to Chikwawa and on to Kituta, conveyed by the African Lakes Corporation. Leaving Chinde on the 8th of June they arrived at Karonga on the 5th of July and at Kituta on the 31st of July. On the 2nd of August they arrived at Moliro (8° 14′ 17″,52 S.L., 30° 34′ 59″,07 E.L.), the first station of the Congo State. There

the work of the Mission commenced. Setting out from Moliro on the 21st of September, Captain Lemaire made observations and determined positions at nine intermediate stations, one of which was Kisabi (8th of October 1898), 8° 1′ 48″,26 S.L., 29° 6′ 30″ E.L., and another Kasama (11th of October), 8° 7′ 45″,95 S.L., 28° 51′ 40″,20 E.L., and arrived at Mpweto or Pueto (8° 28′ 32″,70 S.L., 28° 52′ 55″,54 E.L.), near Lake Mweru (Moéro) on the 13th of October. There he explored the northern shore of the lake while his baggage was being forwarded by boat to the southern end where the village of Kabesa or Kabeça (9° 23′ 21″,07 S.L., 28° 21′ 16″ E.L.) was the point of concentration for the caravan. A series of observations was made at Mpweto and at three intermediate stations, one of which was Molinga (18th of January 1899), 9° 17′ 25″,82 S.L., 28° 24′ 33″,52 E.L., along the western side of Lake Mweru. After a stay of ten days at Kabesa the Mission proceeded to the south-west, crossed the Kundelungu massif, and arrived on the 20th of February 1899 at the station of Lofoi (10° 11′ 43″,74 S.L., 27° 25′ 23″,86 E.L. Observations were made and positions determined at five intermediate points. The highest point of the Kundelungu or Mukingengamba (Mou-Ki-n'Ge-n'Gamba, as M. Lemaire writes it) along the line of route is 1750 m.

At Lofoi, as at Moliro, Captain Lemaire had a meteorological station established. Meanwhile he sent a member of the Mission to explore the country up to Moashia or Moachia, and himself made a reconnaissance of the Lufira, exploring the narrow gut through which the ancient lake where is now the site of Lofoi has been drained, and visiting the Kiubo or Kioubo Falls called Djuo by its discoverers, MM. Böhm and Reichard. The position of the Falls of Kiubo on the Lufira river is 9° 30′ 49″,50 S.L., 27° 2′ 25″,08 E.L. He returned to Lofoi by way of Lukafu (Lou-Kafou), the position of which is 10° 30′ 50″ S.L., 27° 33′ 9″,91 E.L. The position of sixteen points, one of which was Moambwe or Moambe (10th of May 1899), 9° 53′ 23″,82 S.L., 27° 30′ 59″,81 E.L., was determined in the course of this journey. On his return to Lofoi Captain Lemaire organised his caravan to explore the country between Katanga and Lake Dilolo.

On the 28th of June 1899 he left Lofoi with an escort of 550 soldiers and porters, touching on the 17th of July the Lualaba, on the right bank at Kapemba (formerly Kazembe), 10° 45′ 11″,56 S.L., 25° 46′ 44″,86 E.L., and on the left bank (28th of July) at Nzilu (or N'Zilou), 10° 30′ 17″,99 S.L., 25° 30′ 42″,91 E.L. On the 9th of August he arrived at the right bank of the Lubudi, where it receives the Kiweshi (Kiwechi), 10° 2′ 45″,55 S.L., 24° 46′ 19″,06 E.L., and proceeded up its valley to Pakalwa (10° 35′ 20″,63 S.L., 24° 40′ 47″,92 E.L.), where he arrived on the 15th of August. After crossing the Kuleshi or Lukuleshi (Lou-Koulechi) and the Lulua (Lou-Loua) he arrived at the right bank of the Upper Kassai a little below Funda (Founda), or Difunda, on the 6th of September, the position of his camp being 10° 30′ 47″,95 S.L., 22° 16′ 29″,97 E.L. He then proceeded up the valley of the Kassai, and arrived at Lake Dilolo (Di Lolo) on the 12th of September 1899. The position of Lake Dilolo (western side) is 11° 30′ 3″,08 S.L., 22° 2′ 39″,74

E.L. Between Lofoi and Lake Dilolo Captain Lemaire determined the position of forty-two points. His visit has solved the problem of Lake Dilolo. It has no connection with the Congo system through the Kassai, and its connection with the Zambezi is intermittent. It forms a separate hydrographic system, but in the rainy season, when it overflows, it drains into the Zambezi through the Lotembwa. Between the Kassai and Lake Dilolo Captain Lemaire crossed the commercial highway of the Wabundu or Wambundu (Wa-m'Boundou), which leads from the coast of Angola to Tanganyika and follows for a considerable way the Congo-Zambezi divide.

From Lake Dilolo Captain Lemaire proceeded on his return along the Congo-Zambezi divide, the summit of which he crossed twenty-five times, and surveyed now the Congo watershed and now the Zambezi watershed. In the course of this itinerary he visited and located the sources of the Kuleshi (or Lukuleshi), the Lubudi, the Lufupa, the Kapombo (Zambezi), the Lualaba, and the Lufira, or one of its head-streams, the Mwemwashi (Mwe-Mwachi), and many others. It was on the 7th of October that he arrived at Yamwana (Ia-m'Wana), 11° 10′ 53″,08 S.L., 24° 36′ 13″,17 E.L., on the right bank of the Kuleshi. He then followed this stream to its source, 11° 24′ 3″,71 S.L., 24° 27′ 0″,85 E.L., and thus discovered the primordial sources of the Congo. He then passed (13th of October) into the basin of the Zambezi, and determined the position of the village of Kapokosso, the longitude by lunar culminations, 11° 32′ 27″,08 S.L., 24° 34′ 35″,40 E.L. The source of the Lualaba, where he arrived on the 23rd of November, is located in 11° 45′ 29″,01 S.L., 26° 32′ 17″,17 E.L. The Lukuleshi rises at an altitude of 1490 m., and the Lualaba at 1470 m. The source of the Mwemwashi (a head-stream of the Lufira), which rises at Peak De Gerlache, is located in 11° 58′ 23″,66 S.L., 26° 53′ 51″,33 E.L. On his way down the Lufira he determined the position of Ntenke (N'Tenké), which is the name of the chief, the name of the village being Pakamubambe (Pa-Kamoubambé), 11° 20′ 58″,21 S.L., 26° 52′ 27″,16 E.L., and the altitude 1186 m. The village of Mishiru (Michirou), chief of Katanga, is located in 11° 17′ 47″,25 S.L., 27° 5′ 47″,01 E.L. He arrived at Lukafu on the 21st of December 1899, and at Lofoi on the 10th of January 1900. Between Lake Dilolo and Lofoi he had determined the position of forty-four points, the longitude of three of these being ascertained by lunar culminations—the village of Kapokosso, 13th of October 1899, 11° 32′ 27″,08 S.L., 24° 34′ 35″,40 E.L.; the source of the Kamishi (Ka-Michi), an affluent of the Lualaba, 14th November 1899, 11° 48′ 25″,70 S.L., 25° 44′ 44″,76 E.L., at an altitude of 1475 m.; Muimbwa (Mou-Imbwa), or Kilemba (Ki-Lemba), 13th of December 1899, 11° 4′ 14″,26 S.L., 27° 11′ 21″,06 E.L.

When proceeding from Lofoi to Mpweto (or Pueto), Captain Lemaire skirted the western scarp of the Kundelungu massif—Kitinda in the south-west and Mukingembamba in the north-east—and passed into the valley of the Lubule (Lou-Boule), or Luwule, in the vicinity of Ngela (or Ngwela or Gela) which is not in the basin of the Lubule, but on the right bank of the Luambaji (Lou-Ambaji), a feeder of the Lufua (or

Lufwa) tributary of the Lufira. The position of Ngela is 8° 55′ 36″,87 S.L., 27° 45′ 23″,51 E.L., the longitude being ascertained by lunary culminations, 10th of February 1900. Between Lofoi and Mpweto he determined the position of fourteen points. On the 7th of April he arrived on the shore of Tanganyika at Baudouinville, the position of which as determined by him is 7° 3′ 8″,10 S.L., 29° 42′ 55″,46 E.L., the longitude having been ascertained by lunar culminations, on 12th of April 1900. Between Mpweto and Baudouinville observations were made and positions determined at nine localities, one of which was at Kisabi on the 28th of March 1900, where observations had been made on the 8th of October 1898. From Baudouinville Captain Lemaire proceeded to Mtowa or Towa, passing through Lusaka, 7° 9′ 9″,84 S.L., 29° 25′ 35″,78 E.L. (23rd of April 1900); Saint-Antoine, 6° 52′ 20″,11 S.L., 29° 30′ 18″,80 E.L. (27th of April); Mpala or Pala (M'Pala), 6° 44′ 14″,77 S.L., 29° 31′ 36″,44 E.L. (28th of April); St. Victor de Tembwe, 6° 31′ 38″,55 S.L., 29° 26′ 38″,42 E.L.; Ganjia, 6° 12′ 2″,06 S.L., 29° 19′ 18″,19 E.L. (3rd of May); Ngubwa or Gubwa (N'Goubwa), 6° 2′ 32″,26 S.L., 29° 11′ 52″,94 E.L., which is or was also called Albertville; and Mokabwe, 5° 52′ 14″,45 S.L., 29° 16′ 9″,96 E.L. The position of Mtowa, as determined by Captain Lemaire, is 5° 42′ 59″,29 S.L., and 29° 22′ 39″,96 E.L., the longitude having been ascertained by lunar culminations on the 10th of May 1900. Between Baudouinville and Mtowa the position of ten localities was determined. From Mtowa Captain Lemaire followed the caravan highway through the Manyema territory to Kasongo, where he arrived on the 4th of June. Between these points observations were made and positions determined of eighteen localities. The chief of these were Mifusho (Mi-Foucho), or Sungula, 4° 55′ 37″,97 S.L., 28° 23′ 40″,46 E.L. (23rd of May); Kabambare (Ka-Ba'm'bare), 4° 41′ 15″,24 S.L., 27° 42′ 46″,31 E.L. (28th of May). The position of Kasongo is 4° 31′ 36″,75 S.L., 26° 36′ 30″,14 E.L., the longitude having been ascertained by lunar culminations on the 6th of June 1900.

The descent of the Congo was made in pirogues from Kasongo to Stanleyville, where Captain Lemaire arrived on the 2nd of July; whence he was conveyed by the steamer *Princesse Clémentine* to Bumba, and thence by the steamer *Président Urban* to Stanley Pool, where he arrived on the 21st of August. Between Kasongo and Léopoldville eighteen intermediate points were determined, the chief of which are: Nyangwe, 4° 13′ 47″,10 S.L., 26° 12′ 19″,46 E.L. (15th of June); Lokoli (or Nsandwe), 3° 8′ 52″,05 S.L., 25° 57′ 20″,53 E.L.; Lukandu (or Riba Riba), 2° 31′ 32″,01 S.L., 25° 47′ 4″,12 E.L. (20th of June); Lowa, 1° 24′ 1″,54, S.L., 25° 50′ 59″,04 E.L. (25th of June 1900); Ponthierville, 0° 22′ 12″,13 S.L., 25° 28′ 44″,06 E.L. (29th of June 1900); Stanleyville, 0° 30′ 29″,31 N.L., 25° 14′ 5″,68 E.L., the longitude having been determined by lunar culminations on the 5th of July; Bumba, 2° 10′ 25″,89 N.L., 22° 30′ 49″,71 E.L. (17th of July); Coquilhatville, 0° 3′ 59″,29 N.L., 18° 18′ 20″,05 E.L. (29th of July); Équateurville, 0° 1′ 52″,23 N.L., 18° 16′ 18″,70 E.L.; Irebu, 0° 36′ 40″.96 S.L., 17° 48′ 3″,77 E.L.; Léopoldville, 4° 19′ 45″,42 S.L., 15° 17′ 4″,33 E.L. (25th of August).

Captain Lemaire had with him the latest map of the Congo State published in 1898, and not one of the important points of the eastern and southern zone was accurately located. Lofoi, the Falls of Kiubo (Juo of old maps), Bunkéia (the residence of Msiri), the Nzilu gorge or gut; the Kassai, Lake Dilolo, the whole of the 800 km. of the Congo-Zambezi divide were all inaccurate, the difference of position amounting to 35 km., and in one case 1° of latitude. In the same way Baudouinville, Mpala, Mtowa, Mifusho, Kabambare, Kasongo, and others are all removed west. The western shore of Tanganyika and the Lualaba are found nearer together by 60 km.; their relative position may now be considered as finally ascertained.

Altitudes have been omitted in this account, as Captain Lemaire has found it necessary to modify them somewhat while the map was in the press. The following is a list of revised altitudes: Tanganyika, 854 m.; Moliro, 898 m.; Mpala, 886 m.; Mtowa, 899 m.; Lake Mweru (Moéro), 972 m.; Mpweto, 1002 m.; and Lofoi, 936 m.

To complete this account of his itinerary it is only necessary to add that Captain Lemaire left the Congo on the 3rd of September 1900 on board the steamer *Philippeville*, and arrived on the 24th of the same month at Anvers. He has now produced fifteen memoirs on his astronomic, magnetic, and altimetric observations, and a map in two sheets of his itinerary on a scale of 1 : 1,000,000. Cartographers may well believe that accuracy has now been attained for many of the chief localities in the Congo State, and Captain Lemaire may well be congratulated on the success of his Mission, and the work thereby achieved. S. H. F. C.

GEOGRAPHICAL NOTES.

The Meeting of the Geographical Section of the British Association in Glasgow will be the subject of an article in an early number. The papers by Dr. H. R. Mill and Captain Charles Lemaire, published herewith, were read before the British Association.

The Shire Highlands (or Central Africa) Railway.—Many members of this Society and readers of this Magazine will be gratified to learn that an agreement has been concluded, on the 3rd of September, between the Government and the Shire Highlands Railway, Nyasaland, Company for the construction of a railway in the British Central Africa Protectorate. If the Company provides within six calendar months from that date a certain sum of money to be devoted to the construction of the Central Africa Railway, the Government by the Crown agents will enter into a contract with the Company. The prescribed sum is to be raised by an issue of Debentures of the Company constituting a first charge on all the present and future assets of the Company. The railway is to start from Chiromo and thence proceed to Blantyre, and subsequently to Lake Nyasa. The Company is to have the use of plans, surveys, and reports in the possession of the Government, but the Government may require an additional survey to be commenced within three months from the *date* of the contract, and completed within nine months, and the railway commenced within fifteen months from the same date. The railway is to be built in sections of twenty miles. At least one train is to be

run daily in each direction at an average speed of not less than twenty miles an hour. The railway is to be a single line upon the three feet six inch gauge. The Company may, with the consent of the Government, lay down on all or any parts or part of the railway an additional line of rails. At the end of each section a stone pillar is to be erected with marks cut thereon telling the number of miles from Chiromo. No competing line is to be constructed in the Protectorate for twenty-five years, and the Company is to have the first offer of constructing and working any extensions of the railway or branches connected therewith. But if the Company refuse or neglect to construct any extension or branch of the railway that may be agreed upon, the Government may grant a concession to any other company or person. In that case the Company is to have running powers over any other railways constructed in the Protectorate. The Government is to have the right to purchase the railway any time after it has been opened for twenty-five years on giving twelve months' previous notice. The Company is to be British, and the Directors to be British subjects.

The Cultivation of Coffee throughout the World is the subject of an interesting geographical study, illustrated by maps, by M. H. Lecomte, in *La Géographie*, June 1901. The subject is treated in three sections: the geography of the natural species of coffee; the distribution of coffee-growing throughout the world; and the consumption of coffee in various countries.

The coffee-plant belongs to the genus *Coffea*, of the family Rubiaceæ. The latter, which is the fourth in the numerical importance of its species, is distributed chiefly in the warm regions, and no travelling botanist can fail to remark the great abundance of the Rubiaceæ in tropical forests. This family is, on the other hand, poorly represented in temperate lands; although it includes, in all, more than 300 genera and 4,000 species, there are no more than 6 genera and 60 species in France, and only 14 species in Belgium. The tropical flora is incomparably richer in the Rubiaceæ; indeed, it would be easy to show that the family is one of the most extended in tropical regions. Oscar Drude states that 75 *per cent.* of its species are tropical and affect especially the hot, damp forests. Of 712 species of the Congo Free State, described by Durand and Schinz, the Rubiaceæ come first with 75 species, the Leguminosæ second with 73, then the Compositæ with 64, and the Labiatæ with 33. This family includes a considerable number of useful plants, e.g. *Cinchona*, *Cephalis*, *Ipecacuanha*, *Rubia tinctorum*, *Uncaria Gambir*, etc.

The species which is most cultivated is *Coffea arabica* L. Notwithstanding the general opinion, it is improbable that the shrub is a native of Arabia, where it has never been found wild; it has, on the other hand, been long known in Abyssinia, where it is called *Boun*. The Abbé Raynal thinks that it is a native of Abyssinia, and that it was carried into Arabia by Ethiopian conquerors; and Charles-Jacques Poncet, who travelled in Ethiopia in the years 1698, 1699, and 1700, reports the cultivation of coffee in that country.

This is not the only species which is native to Africa; a large number are known both on the east and west coasts. On the west coast there are 22 species. The indigenous species of Asia are all mountain plants.

Of the numerous species of coffee the *arabica* is the only one largely cultivated, though recently one or two other species have been grown to a small extent; but all the species which can be utilised belong to that region in Africa between 15° N. and 15° S. latitude. The Asiatic varieties have no commercial value, and in America where it is so much grown it is not indigenous.

Till the beginning of the eighteenth century Arabia held a monopoly in the cultivation of coffee. It was shipped to Europe direct from Arabia by the Cape,

or was purchased in Egypt, whither it had been brought across the Red Sea. Attempts to grow it from the bean were so unsuccessful that it was supposed that the Arabians soaked the beans in boiling water or dried them in hot furnaces. At the end of the seventeenth century, however, the beans germinated perfectly at Batavia, so that to the Dutch belongs the honour of first acclimatising the coffee plant outside Arabia.

The Governor of Batavia sent a plant to Amsterdam and a specimen was brought to France by Lieutenant de Ressons. It was placed in the *Jardin des Plantes* at Paris and bore flowers and fruit, but did not live long. In 1714 the magistrates of Amsterdam gave a new plant to Louis XIV., and it was sent to the royal garden in Paris. From this coffee plant sprang those which were transplanted and have multiplied in the French colonies. The first attempt at acclimatisation was made at Martinique in 1716, but this was a failure. In 1723, however, Captain de Clieux, who was voyaging to Martinique, was intrusted with a plant. The story of his devotion has often been told: the passage was long and perilous, and fresh water became scarce. De Clieux, who was impressed with the importance of his commission, and anxious to secure a new source of wealth for his country, shared his meagre supply of water with the precious shrub, which, thanks to his care, reached Martinique in good condition. At the first harvest it yielded two pounds of beans; these were distributed over the island, and in February 1726 there were nine trees twenty months old, 2000 smaller ones, and many more just above ground. An unfortunate event hastened the development of coffee culture. Till then the chief industry of the country consisted of cocoa plantations, but a severe earthquake, in 1727, destroyed the plantations, and the colonists in future grew coffee instead of cocoa. Soon Martinique produced more coffee than could be consumed in France.

From Martinique the coffee plant was carried to the other Antilles, and to Central and South America; and now, after less than two hundred years, the countries of America, and especially Brazil, are the chief producers. In Java, where the first attempts at acclimatisation were made about two centuries ago, the development of the industry has not been great; Arabia, which used to supply Europe, now produces a very small quantity; and Martinique at present produces scarcely enough for home consumption, and Brazil, where cultivation was insignificant a hundred years ago, is now the great producer.

Numerous and very various are the circumstances which determine the principal subjects of cultivation in any country. The full study of these conditions is of great interest, but only a few of them can be mentioned, such as climate, character, and fertility of soil, means of communication, cost and quality of labour, the history of colonisation, the influence of governments, the taxes in the lands of production, and the tariffs in those of consumption.

As regards the New World, one may say roughly that coffee is cultivated between the tropics; but not all sections of this vast region are equally suitable for it. In the east there are no important plantations near the Equator; in the west, on the contrary, there are very extensive plantations in the state of Ecuador, for the high mountain chain makes it possible to cultivate at a considerable altitude and also prevents that dry season which occurs in all mountainless equatorial regions. This is certainly the reason for the success of coffee-growing in Ecuador; for close to the sea, where the annual rainfall is very small, it is not possible to grow it. The same may be said of the coast of Peru.

Brazil is the choice country for growing coffee. Till the beginning of last century Brazil did not grow much, but now it produces three-fifths of the coffee which finds its way to the markets of the world. At first the plantations were

confined to the province of Rio, then they stretched north to the province of Spirito Santo, latterly they have been extending south into San Paulo and even into Minas Geraes. Some of the plantations are enormous. There is one, thirty kilometres from Ribeiro Preto, which covers 6000 hectares and contains 4,700,000 coffee bushes. 8000 Italians are employed to work it. It is estimated that in the year 1900-1901 Brazil will have exported 9,000,000 bags of coffee.

Coffee is also ground and exported by Dutch Guiana, Venezuela, Colombia, and all the states of Central America; Cuba, Jamaica, Porto Rico, and Martinique, all produce a little, but not so much as formerly. In Africa, coffee is grown principally in Abyssinia and the Congo State. The industry has also spread to many of the islands in the Indian and Pacific Oceans.

The countries where most is grown are between the tropics, but not close to the equator. The New World holds the first place, actually producing five-sixths of the world's supply, and this accounts for the influence of the American harvest on the price of coffee. Since 1895 the price has been going down steadily, because of the enormous Brazilian crops. These, however, come from the virgin soil of the province of San Paulo, and its productiveness is bound to diminish unless the planters enrich the soil, which they can scarcely afford to do at present prices.

It is difficult to estimate the amount of coffee used in the countries where it is ground, but very easy to arrive at figures for non-producing countries. France uses about 1·82 kilog. per head per annum, England ·39, Belgium 3·85, Russia 0·05, Italy 0·42, United States 3·95. Several facts are worth noticing in this connection. Northern European countries drink a great deal more coffee than Southern European. In all countries where the consumption is important it increases rapidly each year. The small amount used in England is counterbalanced by the large consumption of tea. The use of coffee is steadily increasing from year to year, and the increase would be still more marked if both coffee and sugar could be imported duty free; but the influence of tariffs must not be over-estimated, for the duty paid in France only amounts to two centimes on every cup. The fact that more coffee is used in France than in Spain, and more in Sweden than in France seems to indicate a decided climatic influence on the use of such beverages as tea and coffee.

NEW BOOKS.

Twixt Sirdar and Menelik. An Account of a year's expedition from Zeila to Cairo through unknown Abyssinia. By the late Captain M. S. Wellby, 18th Hussars. London and New York: Harper Brothers, 1901. 65 Illustrations. *Price* 16*s.*

The book gives an exceedingly interesting account of the author's journey from Adis Ababa to the Nile, as well as an account of his impressions of Abyssinia and the Abyssinians. It is greatly to be regretted that the author's life was cut short, for he died at Paardekop on August 5, 1900, before the book was published. He had had a brilliant career, and this volume shows that he was a good explorer, and that had he lived we might have expected still further geographical work at his hands.

With regard to the Abyssinians, whilst not ignoring their faults, Captain Wellby had a distinct impression that they have the making of a great nation in them, and that the difficulties that travellers and others have in dealing with them is simply due to their absolute ignorance of anything outside of their own country, and that their raiding propensities have been solely fostered by the unlimited

supply of arms and ammunition which have been poured into the country by greedy Europeans. He seems to have exerted, personally, great influence over the people, and was able to go about amongst them when other Europeans could only go with an escort. He became a firm friend of Menelik's, who aided his projects in every way, and he was able to perform the hitherto unknown feat of taking a band of Abyssinians with him out of their country to Fashoda and Khartoum.

Every one will read with interest his description of the King of Abyssinia on the march, and the exceptional disposition of the force whilst on the march, the order of camping, and the admirable system of transport, sham fights, etc., which are fully detailed. He has added much to our knowledge of the country between Abyssinia and the Sobat.

In writing of the Sudan problem, he gives utterance to a sentiment which may well be quoted, as its wisdom is indubitable. "As I reflected on the country we have traversed, I could not help remarking to myself that had I the distribution and administration of this newly conquered land, I should feel inclined to hurry through the many miles of burning sand, and leave them, so to speak, untouched, and seek the more profitable and fertile regions farther south."

Captain Wellby was accompanied by Shahzad Mir, who carefully mapped hundreds of miles of unknown land. It is a pity that the map is not published in this volume, which has only one or two rough sketch maps. The illustrations are very good, and the book can be cordially recommended.

The West African Year-Book, 1901. London: The West African Publishing Syndicate, Limited. Pp. xiv+306. *Price 5s. net.*

This being the first issue of a handbook on West Africa, we welcome its appearance. Dealing first with questions relating to West Africa in general, it goes on to treat of the countries in detail: Ashanti, The Gambia, Gold Coast and Ashanti, Lagos, Liberia, Niger Coast Protectorate, Sierra Leone and Togoland; chapters are also devoted to a mining section. The data on the geography, administration, and commerce of the various countries will be found of special service and value, and in the commercial section comparisons for previous years are given showing the now increased trade and industrial development. Sketch maps and good illustrations add to the value of this useful handbook.

The Malvern Country. By Bertram C. A. Windle, D.Sc., F.R.S., F.S.A. Illustrated by Edmund H. New. London: Methuen and Co., 1901. Pp. 236. *Price, cloth, 3s.*

These notes on the Malvern country, principally historical and architectural, will be found useful to visitors. Besides Malvern itself, Worcester, Hereford, Tewkesbury, and other places in the neighbourhood are described. The book is not exhaustive, and is evidently not intended to replace the ordinary guide.

The Delagoa Directory for 1901. Lourenço Marques: A. W. Bayly and Co. Pp. 100. *Price 2s. 6d.*

This is now the third issue of the *Directory*, which contains very useful information regarding the town and port of Lourenço Marques.

A Guide to Chamonix and the Range of Mont Blanc. By. Ed. Whymper.

A Guide to Zermatt and the Matterhorn. By Ed. Whymper. London: John Murray. Geneva: Henry Kündig, 1901.

The author has kindly sent us copies of the 1901 issues of his guides. We can only reiterate the praise and recommendation bestowed on them in previous years.

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SOUTHERN CENTRAL AFRICA

SHOWING RECENT EXPLORATIONS AND RAILWAY SCHEMES.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE SCOTTISH ANTARCTIC EXPEDITION.

By W. S. Bruce, F.R.S.G.S.

A year ago I drew up plans for a Scottish Expedition to the Antarctic.[1] According to the original scheme, the Expedition was to extend over a period of three years, and the programme included a wintering station on a high southern latitude. For many reasons, I have deemed it necessary to make considerable alterations in the original plans.

It is my duty now to make a definite and final announcement with regard to the Expedition in its amended form. I have been successful in raising sufficient funds for one complete year's work in the Antarctic, and the money has been subscribed entirely by Scotsmen. The ship will leave these shores next year in the autumn. This delay in starting can only be looked on as a decided gain. Extensive preparations must be made, the staff must undergo special training both at home and abroad, tidings will possibly have reached us of the two expeditions already in the field, and from meteorological and other scientific standpoints the departure a year hence will be of the greatest ultimate advantage.

The route we shall take is precisely that indicated in the original plans of the Expedition. In this connection one important change will have to be made. No winter station will be established. I have been compelled in the meantime to abandon this part of the programme, both by the force of circumstances and after long and exhaustive consultation with Continental experts. Both the German ship *Gauss* and the British ship *Discovery* have been specially built for magnetic work, and will have to make great sacrifices to carry on that most important work effectively. Both will remain frozen up in the ice during the Antarctic winter. My opinion is, that a free moving ship constantly doing work on the

[1] Vide *The Scottish Geographical Magazine*, June 1900.

Challenger-Valdivia lines for a whole year, both within and without the Antarctic Circle, is the greatest present need. This is manifest even from a purely Geographical standpoint. Contours of land areas will be determined, Geological, Zoographical, Oceanographical, and Meteorological research will be actively pursued during the whole voyage. As occasion arises, land journeys of short duration will be undertaken also for the purpose of Geological and other investigations.

If the ice conditions in the Weddell Sea should prove favourable, we shall push southwards as far as is prudent, just as Weddell did. But in no case is it my intention to allow the ship to be caught in the ice, as its sphere of utility becomes at once limited, and the gain is not commensurate with the risks involved.

In connection with the Expedition several Meteorological stations will be established at different parts if funds permit, and I regard such stations as highly important. Possibly the German International Station of 1881-82, at S. Georgia, may thus be re-established, and even another in the far South, if funds permit. This latter should be in as high a latitude as it is possible to attain, not only for its scientific interest, but because there we shall have finer and calmer weather, and thus be able to carry on work more comfortably and efficiently. The unknown region around the South Pole is undoubtedly within the area of an anti-cyclone, especially in summer time. Outside this is a great barometric trough encircling the Globe, the limits of which the *Valdivia* found to be in 55° S. south of Africa, and 56½° S. south of Kerguelen. The *Belgica*, in 70½° S., 86° W., lay in winter in the Equatorial and in summer on the Polar side of this trough, and the Newnes-Borchgrevink Station at Cape Adare lay persistently on the Polar side, and in winter was actually drawn into the anti-cyclone itself. For the investigation of the higher strata in the atmosphere kites will be employed. I am far from convinced that captive balloons will be of great service under climatic conditions like the Antarctic; besides, their successful manipulation from the deck of a ship seems to me well-nigh impossible. For that reason none will be taken with the Expedition.

On board, I intend to have the Sigsbee and Lucas Sounding Machines, and to devote particular care to the investigation of the region in 68° 34′ S., 12° 49′ W., where Ross got the oft-quoted and much-disputed sounding of "4000 fathoms and no bottom." To see if the great deep, discovered by the *Valdivia* between Bouvet Island and Enderby Land, extends far towards the westward, will also be an object demanding especial care. The Marine Biology of the Antarctic will form an important feature of the Expedition, and elaborate preparations will be made on board for this particular branch of research. Marine Mammalia, especially the Cetacea, will be carefully studied, and special gear will be on board for that object; and it is hoped a unique collection of such material will thus be brought together. Laboratories will be fitted up on board fully equipped for the needs of Oceanographical Research. The currents, temperature, salinity, and density of the sea from the surface to the bottom will be observed —in fact, all observations essential for an Oceanographical Expedition will be taken.

The Weddell Sea and its immediate neighbourhood present a field for scientific operations surpassed, if indeed equalled, by none other in the Antarctic regions. I have attempted to demonstrate this opinion on numerous occasions; and it is particularly gratifying to me, as organiser of the Scottish Expedition, to find this opinion shared by others. But for magnetic considerations the Germans would undoubtedly have settled on this region for the scene of their operations. I have Drygalski's authority for the statement, and it has given him particular satisfaction that the region has been taken under Scotland's wing in the scheme of International Co-operation, or, as I prefer to put it, "division of labour."

The ship's *personnel* will consist of thirty men all told, including a scientific staff of eight and twenty-two officers and crew. I shall undertake the zoological work of the expedition and be accompanied by a geologist, a meteorologist, a physicist, a medical officer (bacteriologist), an artist, and two assistant scientists. The navigation of the ship will be intrusted to an experienced ice-master, who will have under him four officers and a crew of seventeen. The ship which is being secured for the work is a wooden one of the whaler type of 500 tons, and steaming seven knots.

In projects of the magnitude of a Polar Expedition, it is well to know how the plans are being received by experts, especially abroad. To this end, I have now to submit the opinions of several eminent men of science on the Continent as to the need for, and the utility of an expedition such as the Scottish Antarctic Expedition, as well as to the degree of success likely to be attained by such an expedition.

Professor F. Frhr. von Richthofen writes:—

"The joining of a Scottish Expedition to those which are already at work on the part of Germany and England would greatly enhance the value of this great enterprise, which may truly be called international in conformity with the nature of the object they commonly pursue. Every new chain of observations by which the Southern Pole is to be enriched, and if the success we anticipate is obtained, it will be to the honour of those nations which shall have had a share in it.

"It would be a great satisfaction to all those who take an interest in the Antarctic problem and in the work which is actually being done towards completing the knowledge of our globe, to learn that Scotland takes an active part in it."

Professor Erich von Drygalski, Leader of the German South Polar Expedition, writes:—

"If I had not fixed on the Kerguelen route for the German Expedition, I would have made the Weddell Sea my starting-point. The former has in its favour the more interesting magnetic problems to be settled there. The Weddell Sea on the other hand is as interesting, if not more so, from an oceanographical point of view. At present very little indeed is known of the currents in the Antarctic. By exploring

the Weddell Sea, important results may be expected with regard to these currents, and explanations given for the ice pressure which Weddell and Ross, and, later, the *Jason* and the *Hertha* experienced. You will find in the Weddell Sea, without doubt, one of the most interesting fields for oceanographical research that the world can offer. The Weddell Sea is also a most favourable starting-point for biological and other investigation in the Antarctic. From the point of view of the German Expedition a station in these parts would be specially desirable, as it is quite possible we may have to pass out this way from the Antarctic, and it would be most important to find work done by another expedition in this region.

"I strongly advise you to direct your attention chiefly to oceanographical and meteorological research work. I consider it of little importance to establish further magnetic stations as they are not necessary, and I approve most thoroughly of all your plans."

Professor CARL CHUN, Leader of the German *Valdivia* Expedition, writes:—

"Since the Antarctic Expeditions already sent off have their centre of activity in geophysical research work in the Antarctic regions, it appears to me that an expedition with oceanography as an essential feature is a most necessary correlative. It promises to have a certain and a complete success. Since it deals with the settlement of the question whether our earth possesses a sixth continent, or whether the different lands that have been sighted in the Antarctic indicate only isolated groups of islands, it lies in the nature of things, that once and for all contours will be determined. Since the ice-barriers prevent one from reaching the mainland, it has been impossible so far to settle the question. What surprising results may be looked for, not only in the proximity of land but also at great distances, has been demonstrated by the *Valdivia* Expedition, which investigated depths of over 3000 fathoms from the Bouvet region to Enderby Land.

"The question arises whether these great depths are to be found westward from the Bouvet region in the Weddell Sea. The much discussed sounding of Sir James Ross appears to make this highly probable, but it requires to be substantiated by as complete and exhaustive a series of soundings as is possible. Besides, the experiences of Weddell indicate favourable ice conditions in the unknown south of the Weddell Sea. An expedition with its sphere of operations here, would do yeoman service to geographical research, and perhaps achieve most surprising results.

"In the proximity of land where ice-barriers prevent further progress, rock specimens brought up by the trawl would furnish direct evidence as to the geological characters of the region. According to the "finds" of the *Challenger* and the *Valdivia*, there exists apparently an Archæan formation between Victoria Land and Graham's Land. Of course, whether the land south of the Weddell Sea is of this nature or not, can only be settled by future investigation. The bottom samples which have been taken from the greater depths of the Antarctic Ocean, do not betray

a monotonous character according to the investigations of Sir John Murray and Dr. Philippi, as one might at first suppose. Besides the occurrence of diatomaceous ooze, volcanic mud, and radiolarian ooze, even globigerina ooze is found at one place south of the Kerguelen Island.

"The investigation of the peculiar temperature stratification of the water in the Antarctic requires to be further extended. The Bouvet region appears to be characterised by particularly unfavourable climatic conditions, and the question arises whether this stratification holds good farther westwards also, and what explanations it affords for the so wide distribution northwards of the cold water in this region.

"Further observations on the surface currents, on the salinity, density, and chemical composition of the sea-water from the surface to the bottom, can never be sufficiently numerous, and so an oceanographical expedition under all circumstances will do a great service to science.

"It goes without saying that our knowledge of the biology and the meteorology of the Antarctic will also be very considerably increased by the work of such an expedition as yours. An Antarctic expedition with oceanographical pursuits as one of its essential features, and which might extend its field of operation from the Weddell Sea to the South Pacific determining the contours of the mainland, has my cordial support."

Professor A. Sprung, Director of Meteorological Observatory at Potsdam, writes:—

"The question as to whether Scotland's share in the international Antarctic Co-operation is a thing to be wished for, I can only answer with a most emphatic "Yes" from a meteorological dynamical standpoint.

"I will attempt briefly to substantiate my verdict. According to Ferrel's theory (to which of course James Thomson has also a claim), the most important part of the general circulation of the atmosphere consists of the two great circumpolar currents which extend from the 33° lat. to the respective Poles.

"The chief direction of movement of the air in these vortices in both hemispheres, and also throughout almost all high latitudes, is from west to east, so that these air-masses, taken absolutely, rotate faster than those portions of the earth's surface lying below them. According to the laws of mechanics, the atmospheric pressure must therefore become smaller and smaller in the direction of the Pole. All the foremost researches (founded exclusively on the higher hydro-dynamics) dealing with the general circulation of the atmosphere, yield as chief results, the diminishing atmospheric pressure towards the Pole, with the air circulation from west to east belonging to it. Oberbeck[1] may be quoted as example.

"To a certain extent we have a contradiction to this theory, for in the

[1] A. Oberbeck: *Über die Bewegungserscheinungen der Atmosphäre.* Sitzbr. der K. Pr. Akademie, Berlin, 1888, S. 383-395 u. S. 1129-1138.

northern hemisphere the mean atmospheric pressure in lat. 65 attains a minimum of about 758 mm., and up to 80 lat. increases again to about 2 mm.

"Ferrel was aware of this fact, and in his numerous publications on the general circulation of the atmosphere, he almost always clearly indicated that the west-to-east movement on the earth's surface did not extend to the Pole itself, but on the contrary in that direct neighbourhood a movement from the east took place again (quite similar to that in the Passat region).

"In one single publication, meanwhile, these east winds of the Polar Cap are left out.[1] Now since this in particular appears to deal with the theoretical case decisively, one gets the opinion as if Ferrel also, just like Oberbeck, from a pure theoretical standpoint can find no place at the Pole for any peculiar phase of circulation.

"With regard to my own opinion, in 1885 in my text-book of Meteorology, I have made my calculations for the lower distribution of pressure according to Ferrel's mean values, which one (under certain assumptions with regard to the change of temperatures with the altitude) might expect from sea-level to the altitudes of 2000 and 4000 m.

"Let me reproduce these figures here in abbreviated form[2]:—

	Northern Hemisphere.								Southern Hemisphere.						
	80 deg.	70 deg.	60 deg.	50 deg.	40 deg.	30 deg.	20 deg.	10 deg.	0 deg.	10 deg.	20 deg.	30 deg.	40 deg.	50 deg.	60 deg.	70 deg.
At Sea Level, . .	760	759	759	761	762	762	759	758	758	759	762	764	761	753	743	738
At 2000 m., . .	582	584	588	593	598	601	601	601	601	602	603	602	597	588	577	570
At 4000 m., . .	445	447	452	457	464	468	470	471	471	471	471	469	463	454	444	437

"The conclusion from all this is, that the theoretical pressure distribution is only well pronounced in the southern hemisphere actually. In the northern hemisphere disturbances have an undue influence. But according to the above figures at altitudes of 2000 m., a continuous and not inconsiderable diminution of pressure is noticeable up to the 80 lat., so that for the Pole itself a further real minimum of pressure is to be expected. Indeed at the altitude of 1 km. the Polar maximum may

[1] W. Ferrel. *Meteorological Researches for the Use of the Coast Pilot*: Washington, 1877. Compare also W. M. Davis, "The Circulation of the Atmosphere" (*Quart. Journ. MS.*, xxv., 1899, pp. 160-169).

[2] This table is to be found in the recently published text-book of Meteorology by Hann, on p. 469, as sufficiently accurate for the purpose "of a general representation of the depression at levels of equal pressure." According to the forthcoming communication of Arctowski's "On the Results of the *Belgica* Expedition" (vii. *Internat. Geograph. Kongress*, 1899, Berlin, II. Part, p. 649), the pressure at 70° lat. S. is about 6-7 mm. higher than is given above. The wind observations allow an Antarctic high-pressure region to be conjectured. The observations and registered results of Nansen's Expedition, 1893-96, which are not yet available, will improve the values for the northern hemisphere.

cease to exist; and since here on the other hand the circular maximum is still well pronounced in the 33 lat. approx., one is perhaps justified to a certain extent in taking into account for the first 1000 m. a conditional peculiar arrangement, through the direct neighbourhood of the raw earth's surface, whilst everything else would obey theory.

"That is only a surmise on my part, and it is based on material which at present is admittedly very imperfect, as I have indicated above. The mean values of the atmospheric pressure, and the temperature on the earth's surface in the tropics, and the median latitudes may not alter very much perhaps through more recent material, but the measurement of temperature—the diminution with altitude—is purely hypothetical. Such important questions as these can only be answered with greater exactness with the help of aëronauts. For that reason in 1898[1] I advocated in a short article, that the chief task of the forthcoming Antarctic Expedition in taking meteorological observations should be performed with the help of kites and captive balloons, and that observations should not be confined to the superficial layers, as has always been the case hitherto. In this way observations could be extended to an altitude of 3000 m.

"More advantages are obtained in this way. In the first place, every observation is more valuable in itself, for the respective atmospheric measurements, for example, of the daily periods are practically completely dispensed with. In the second place, the temperatures taken thus have a greater dynamic significance, *i.e.* for the theory of atmospheric motion, than the temperatures of the layer directly overlying the earth's surface: and thirdly, the temperatures permit of a quite accurate calculation of the atmospheric pressures at higher levels; and lastly, it is of the greatest importance, because a good direct determination of atmospheric pressure at great heights appears quite out of the question, and can only be done on mountain observatories. In no case should any one neglect to take kites with good registration apparatus with them. Captive balloons may then be dispensed with in preference.

"I must yet add, that for the answering or rather solution of the important questions still under dispute, as also for other meteorological questions besides, the number of stations can't be large enough! If one reflects for a moment, a single station would teach us practically nothing definite about the mean-pressure relationships[2] of the latitude, because, as every one knows, everything is not distributed and administered symmetrically round the earth's axis. The individual stations, for example, could lie by chance continuously in a barometric maximum, whereas the pressure on the opposite side might remain considerably lower: but if observations were carried out on different sides, it is to be hoped that a year's observations would be quite sufficient to determine the normal value of the atmospheric pressure to within a few millimetres for the separate latitudes (including the South Pole).

[1] A. Sprung, "Zum Programm der bevorstehenden Polar Expedition" (*Das Wetter*, xv. 1898, p. 113).

[2] I only quote atmospheric pressure by way of example.

"In a still higher degree is a feasible many-sided participation such as yours to be desired for a successful drawing of a synoptical weather chart for the South Polar Regions up to the 30° parallel. The number of co-operating ships and land-stations in the actual Polar region appears, unfortunately, far too small, and the drawing of the synoptical chart will have to be directed entirely by the results of these expeditions themselves."

Professor C. Börgen, Director, Imperial Observatory, Wilhelmshaven, writes:—

"There is such a vast field for exploration in every direction, geographical and scientific, that no expedition can ever be regarded as superfluous provided it be conducted in a truly scientific spirit. In one point at least I am inclined to think it will prove rather lucky if you start a year later than the other expeditions, and this is from a meteorological standpoint, because your observations will add one more year to our stock of information of the meteorological conditions of the Antarctic. The same will apply to the magnetical observations."

Professor Karl Brandt of Kiel writes:—

"The Scottish Expedition supplements the two other Antarctic Expeditions, the German and the English, in a most important point, namely, in deep-sea investigation. Exceedingly valuable results are to be expected from this, as well as biological and hydrographical research. Dredging work in the great depths of the ocean does not form part of the plans of the other Expeditions, as far as is known. Added to this, the Scottish Expedition will cross over the great deep discovered by Ross and also the Weddell Sea, whereas the other expeditions must make direct for their actual field of operations. From the very nature of the projected work, the Scottish Expedition will be able to achieve this successfully. Since all three expeditions will work simultaneously and systematically at three different sides of the Antarctic, their researches will mutually supplement each other and be of most service to science."

H.S.H. the Prince of Monaco writes:—

"I have heard from your letters, papers, and other reports of your important plan concerning a Scotch Antarctic Expedition. Of course, whenever you wish to refer to me I shall be very pleased to answer. I shall also be delighted to help you with some of my material or instruments."

Dr. Fridtjof Nansen writes:—

"I wish you all possible success in your important undertaking. You go to a part of the Antarctic region towards which I have also had my eyes directed, and shall wait with impatience to hear of your achievements."

I have placed before you in the briefest possible way the work to be undertaken by the Scottish Expedition. It gives me the greatest pleasure now to announce that a number of prominent Scotsmen have shown their approval in a most substantial manner by subscribing sufficient money to send off the Expedition. I should like to mention particularly in this connection the name of Captain Andrew Coats, who, three years ago, conducted a most successful expedition to the Arctic regions, and who more recently distinguished himself in the service of his country as Captain of the Glasgow Imperial Yeomanry. Captain Coats has contributed the very handsome sum of £5000 to the Expedition.

The more funds we are still able to secure, the more extensive and valuable will the results of the Expedition be. I appeal therefore to Scotsmen throughout the world to follow the example set by others, and so enable the equipment and scale of the Expedition to be a credit to Scotland and an ornament to Science.

ANTHROPOLOGICAL INVESTIGATIONS IN THE ALPS AND THE CAUCASUS.

By Victor Dingelstedt.

The study of the physical structure of the various human races is an essential element in anthropogeography, and is the means by which we are most likely to achieve reliable conclusions with regard to the origin and early development of mankind. Anthropology is the true basis of ethnology. In our search for origins, neither customs, religion, language, nor any other feature, can give us so much help as those bodily differences which are so remarkably persistent in all races.

There are reasons for believing that anthropological investigations in mountainous regions have a special value; and I therefore desire to call attention to some of the recent work in the Alps and the Caucasus. Although it is not certain that mountains can be considered to have been the primitive abode of man, highlanders, rather than the inhabitants of the lowlands, preserve their ancient qualities in a form which lends itself readily to study. Their proverbial conservatism, the tenacity with which they are knit to their land, and the difficulties of communication, all make for the persistence of racial and tribal peculiarities: there is little intermingling of blood; the dependence of man upon nature is more complete than in other regions, and the influence of nature upon man is more profound. Local differences are strongly marked: and anthropological problems are presented to us in a form in which the essential factors in racial development are comparatively easily seized.

It is undoubtedly the case that all mountainous countries, and in a very special degree the Alps and the Caucasus, contain a comparatively large number of distinct tribes and nations. The latter region presents

an even greater variety of physical types than are found in the former; and it is possible, as some affirm, that these types have been developed by local influences and have been established and preserved by the isolating conditions of mountain life. For while the intermingling of lowlanders tends to obliterate physical differences, by fusing them in a type which is perhaps higher and more complicated, the isolation of the hills and valleys not only preserves existing differences, but even increases them, and creates new ones.

Anthropological studies have been carried on in the Caucasus for many years by that very able and laborious investigator, Dr. J. Pantukof, to whose work I have already called attention in this *Magazine* (Vol. IX.). Since that time, however, the Caucasian anthropologist has not remained idle; and in the *Izvestia* of the Caucasian section of the Imperial Russian Geographical Society (Vol. XIII.) we find a very valuable report on a new ethnological group which has for long been confused with others. This is the Ingoush, a group related to the Tchetchen and the Kisty, enjoying an undesirable notoriety for their propensity to robbery. Their land, which is about 570 square miles in area, is situated almost in the centre of the main Caucasian range, in the neighbourhood of Ossetians, and partly on the high military road which forms the sole means of passage through these lofty mountains.

The number of the Ingoush is estimated at about fifty thousand, of whom about one-fifth remain as yet in the mountain fastnesses, while the rest carry on their depredations in the more profitable regions to the north, on the lower Kabardin and Sunsha parallel ranges. Their principal river is the Ossa, tributary to the Sunsha, which, again, joins the Terek. They are divided into six communities, of which four remain in the higher regions which are difficult of access, and two, more numerous, more civilised, and more prosperous, inhabit the plain between the Black and the Karadagh ranges.

The Ingoush are considered very ancient inhabitants of the Caucasus; but their origin is lost in obscure and even contradictory traditions. They have long been supposed to be identical with the Tchetchen—an error which has recently been disproved by anthropological inquiries, which have shown that they are a distinct ethnical group of men, although they resemble the Tchetchen in their creed, their language, and, for the most part, in their customs.

The Ingoush are widely notorious throughout the Caucasus as brigands and thieves. This deplorable disposition to plunder, partly explained by the very miserable means of livelihood offered by their inhospitable home, has been favoured by other circumstances of their life: their hardihood and intrepidity, their ignorance, the plentiful booty which is constantly carried on the great passage through the main Caucasian range, and the facility with which plunder may be hidden in the scarcely accessible mountain gorges. But recently, in consequence of the repressive measures which have been prosecuted by the Russian government, the Ingoush has somewhat changed his habits. From being a bold and daring brigand, he has become a prudent and cautious thief; instead of going about his business in the daytime with uncon-

cealed weapons, he has learned to work stealthily and in darkness with his weapon hidden, or even unarmed, trusting solely to his skill and vigilance. But this change does not detract from the interest which they have to the anthropologist, and especially to the student of the so-called "criminal anthropology," who may find in these people valuable material for the construction of the type of those who are naturally inclined to violence and robbery.

The complexion of the Ingoush is swarthy; he is tall and slight in form: restless, always on the alert, inquisitive, dexterous, and usually highly intelligent. He bitterly resents treacherous denunciation by one of his own community, and the informer is sure to suffer revenge.

The anthropological characteristics are as follows:—

Cephalic Index.—The ratio between the longitudinal and transverse dimensions of the head varies from 1 : 0·74 to 1 : 0·92; that is, from the dolichocephalic to an almost extreme brachycephalic type. Of fifty-five adults examined, about 80 per cent. proved to be mesocephalic (from 77·8 to 86), 11 per cent. were brachycephalic, and the rest, or 9 per cent. were dolichocephalic. Of the same number of Ossetians 59 per cent. were mesocephalic, 34 per cent. were brachycephalic, and only 7 per cent. were dolichocephalic. The mean cephalic index of the Ingoush is 82·26; while in the case of the Ossetians it is 82·62. Among the Ingoush the mean length of head was found to be 129·78 mm., the mean breadth 156·30 mm., and the mean circumference 556·7 mm.; the corresponding mean measurements for the Ossetians were 189·4 mm., 156·5 mm., and 560 mm. respectively. The face of the Ingoush is longer than that of the Ossetians: the length is about 185·6 mm. (7·24 inches) or 10·6 per cent. of the stature, and is divided as follows: forehead 62·7 mm., nose 53·8 mm., and lower face 69·1 mm., or 33·4 per cent., 29·5 per cent., and 37·1 per cent. respectively. The breadth of the face in the Ingoush is 143·9 mm.: in the Ossetians it is 144·8 mm.

The Nose.—This, which is usually the most characteristic of the features, is more largely developed in all strictly Caucasian nationalities than it is in Europeans; and it would be interesting to know whether their sense of smell is correspondingly keen. It is at least the case that the Caucasians relish various perfumes very highly. The nose of an Ingoush has a mean length of 53·8 mm., the shortest being 44 mm. and the longest 62 mm. It is usually straight, rather big, high, sometimes protuberant, and almost always droops towards the upper lip, so that its length is greater when it is measured from the bridge to the tip than when it is measured from the bridge to the base of the vertical septum between the nostrils. The mean length, in the last case, is, as indicated above, 53·8 mm.; in the former case it is 54·7 mm., or about 1 millimetre more. This drooping of the nose is further illustrated by the measurements of the distance from the upper end of the nostrils to the bridge, this distance being about 6·2 mm. (or ·24 inch) shorter than the length of the nose. The breadth of the nose varies, ranging from 33 to 40 mm.; the mean is calculated at 36·6 mm., or a little less than that of the Ossetians. The height of the Ingoush nose is notably greater than it is among the Ossetians, the measurements being 29·6 mm. and 25·3

mm. respectively. The breadth of the upper part of the nose, or the interocular distance as determined by a few measurements, is greater among the Ingoush (35 mm.) than among the Ossetians (33·3 mm.).

The Eyes.—The Ingoush have for the most part (87 per cent.) brown eyes of a darker or lighter shade; but blue or grey eyes also occur, though far less frequently. It has been suggested that their olfactory powers are very acute; and this may be repeated, with stronger emphasis, with regard to the faculty of vision. This is very remarkably powerful, as it is among the Kurds and other pastoral peoples, and, according to the usual measurements, is estimated at double that of average eyesight. Their look is furtive, restless and anxious, anything rather than open: it was always very difficult to get them, even by payments, to submit to examination.

Stature.—The Ingoush belong to one of the tallest tribes in the world. The mean height obtained from the measurements of fifty-six individuals, taken partly from prison and hospital, and partly at random, was found to be 1728 mm. or 5 feet 7·39 inches. The two extreme measurements were 1640 mm. and 1840 mm. All their members are developed proportionately; but they are narrow-chested, the girth at the chest being generally somewhat less than half the stature (855 mm. instead of 864 mm.). The Ossetians are shorter, but have a broader chest.

The Hair.—The Ingoush have dark hair. The chest is abundantly covered with hair, and so, to a somewhat less degree, is the whole body; and this hairiness constitutes in their case, as in that of the Chaldaeans or Assorians or Abbysians and the Tats of Persia, a very characteristic anthropological feature. The disposition of the hairs on the chest differs from that observed in the Russians: they do not grow in the form of a cross on the middle of the chest, as in the case of the latter, but are fairly evenly distributed over its whole surface, and are seldom massed very closely. The remarkable hairiness of the Ingoush, common to Assorians and Tats, has led some to the conclusion, which awaits full justification, that they are genetically related to these two peoples. The Assorians are ultra-brachycephalic, the Tats are mostly dolichocephalic, and the Ingoush, as we have seen, show a ratio ranging from 1 : 073, or true dolichocephalic, to 1 : 092, or ultra-brachycephalic.

In every respect the Ingoush prove to be, anthropologically, a group of men inhabiting the Caucasus, distinct from their neighbours, the Ossetians, Tchetchen, Lesghin, Kumykh, Circassian and Kabardin, Armenian, Georgian, Hebrew and others. All these peoples differ essentially from them in some particulars: the Ossetians are of a lighter colour in hair and eyes, shorter face, less hairiness and less pronounced brachycephaly. The Tchetchens have a broader face and head, greater skeletal development, larger chest, higher cephalic index (1·084), and less sensibility and more meagre intellectual endowment. The Lesghin also have a broader head, and have less hair, of a lighter shade. The Kumykh are smaller, and have larger cheekbones and larger chest; the Circassians and Kabardin are less brachycephalic and are less hairy; the Armenians, Georgians, and Hebrews have, among other distinctions, a narrower head, shorter stature, and a far greater proportionate number of protuberant noses.

If we should be asked what are the characteristic anthropological features of a predatory tribe, such as the Ingoush, it would be somewhat difficult to give an adequate reply. We might of course indicate those qualities which are common to all peoples of a similar disposition and manner of life, but we should find very few such points to enumerate. And there is little doubt that we should consider all the features of each tribe together, rather than point out such and such particular traits as specially associated with, or indicative of, the habits and temperament which distinguish the people in question. We do not doubt that there is a connection between mental disposition and physical structure, and that the investigation of the Ingoush, which we hope may be carried further, must be of the highest value to the student of criminal anthropology.

Let us now turn to certain recent anthropological inquiries in Switzerland, in which not the living, but the dead have been studied by young anthropologists, who have excavated certain caves with a view to the recovery of long-buried skulls. Only a small beginning has been made in this line of research: the material which has as yet been obtained is very small in amount; and our ignorance of the earlier generations of man is great. But though we are far from sharing the very optimistic views of those young enthusiasts who, having obtained a few skulls, consider themselves able already to trace the origin of the present inhabitants of the Swiss mountains, we must certainly acknowledge the value of further knowledge of what kinds of heads were on the shoulders of these ancient peoples whose remains were buried, in the immemorial past, in the caves of the Schweizersbild and of the Taigen, and in many others which still await excavation.

The Genevan Geographical Society has lately received two or three communications from Messrs. E. Pittard and Schenk, relating to their investigations in Valais and Savoy, and published in *Globus*, vols. xxxviii. and xxxix.; we shall make a short reference to these researches, which their promoters propose to continue.

In 1877 and following years Mr. Abel Novelaigne published, in the *Revue d'Anthropologie*, his studies on the Savoyard skull. These studies have been continued since by Dr. Jules Carret, and the young Swiss anthropologist, already mentioned, Dr. Eugene Pittard. Dr. Carret has published his results in the *Mémoires de la Société Savoisienne d'histoire et d'archéologie* (1882), and those of Dr. Pittard have appeared, as stated above, in the last volume of *Globus*.

We leave aside Dr. Pittard's views with regard to the primitive population of Savoy, as somewhat far-fetched and not sufficiently warranted by facts, and pass directly to his anthropological material, which consisted of 165 skulls, collected from different parts of the country. About 83 per cent. of these skulls have proved to be brachycephalic, 20 per cent. dolichocephalic, and 7 per. cent. mesocephalic. The extreme brachycephaly gives the ratio between longitudinal and transverse dimensions as 1·087. These brachycephalic skulls, belonging, as it would seem, to the majority of the ancient inhabitants of Savoy, are identical with those found in Valais, whence has arisen the somewhat hasty con-

clusion that they belong to the same tribe of men. Both are supposed to have been of Celtic race. This skull is globular in form, the parietal bones are rounded, the sphenoid bones are only slightly developed, and the zygomatic arch is scarcely apparent. The frontal bones are high and large, the temporal bones diverging and salient, the superciliary ridge is strongly marked, the nasal apertures are moderate in size and the orbits are large. The ethmoid bones are salient; the space between the eyebrows (*glabelle*) little accentuated. The ratio of the length to the breadth of the face is as 1·052, which brings most of these skulls under the designation *leptoprosopus* or long-faced. The nose is supposed to have been long and narrow.

No material, worthy of attention, has been secured for the investigation of the stature, colour of hair, and other particulars.

The anthropological inquiries in Valais and Vaatland, conducted by Messrs. Bedot, Scholl, Schenk, and Pittard, were based on a number of skulls found in certain ancient charnel-houses. M. Bedot also examined, for purposes of comparison, over a thousand young men recruited for the army. This simultaneous study of the past and the present generations of men has revealed the fact that in former times the population in Valais, as in Savoy, was mostly brachycephalic, and characterised by a high cephalic index (from 82 to 86), whereas at the present day this brachycephaly has decreased, the mean cephalic index obtained from the measurement of the recruits being from 80 to 83; and there are further to be found about 20 per cent. of dolichocephalic and sub-dolichocephalic people inhabiting the valley of the Rhone. The modern population therefore seems to be somewhat distinct from the ancient. Its mean stature, estimated from the measurement of twelve hundred recruits is 1635 mm., and therefore lower than the stature of the shortest of the Ingoush, which was 1640 mm.

It would be very interesting to carry out a full comparison between the inhabitants of these two high mountain regions, the Caucasus and the Alps. The influence of the environment does not greatly differ in the two cases, but the anthropological distinctions, deriving from different racial origins, are many and very marked. The present writer, who has lived for long periods both in the Caucasus and the Alps, has been struck chiefly by the more pronounced features, and the greatly more acute senses of several Caucasian tribes, than can be observed among the present Alpine population: and would express his hope that anthropologists in both countries will pursue a comparative study, in order that we may obtain a fuller knowledge of the special characteristics of highland peoples; and that, by the systematic investigation both of the dead and the living, they will throw further light upon the causes of the evolution or the degeneration of human structure.

ITINERARIES IN PORTUGUESE CONGO.[1]

By Rev. Thomas Lewis, Baptist Missionary Society.

It is remarkable that a country like that of the ancient kingdom of Kongo, discovered by Europeans in the fifteenth century, should be so little known at the beginning of the twentieth, and that its development should have been so sadly neglected to the present day. The rush of civilisation into Central Africa has naturally been by means of its mighty waterways, and hitherto our knowledge of the interior has been to a great extent confined to comparatively narrow strips on the banks of its rivers and the shores of its lakes. The greater facilities for travelling seem to keep Europeans in the valleys, and this fact may account for the lack of enterprise—commercial and otherwise—on the part of many, in opening up districts where overland transport is a tedious undertaking and a great expense. Perhaps also the government, into whose hands the development of the south-western portion of the Congo has been intrusted, is not so active and energetic as we might wish. At any rate, in years gone by the Portuguese Government were more concerned in the development of their plantations in the West African islands than in the welfare of their Congo territories; and for generations they looked upon the mainland as a rich field to supply West Indian markets with slaves and their coffee plantations with "hands."

Thus, the ancient kingdom of Kongo has been pulled to pieces, and drained out of its best blood and life, because those in power forgot that the only way to develop the country was to develop the character of its people. Until recently the only lucrative business in the country —in which blacks and whites were equally active—was the traffic in human flesh: and even to-day the chief concern of the Kongos is how best to sell one another.

Fortunately the Portuguese Government of the present day shows signs of a desire to open up the country to legitimate trade, and to take its place in the march of civilisation. In 1887 an official Resident was appointed and stationed at S. Salvador. In 1896 a military and fiscal station was established at Makela, not far from the boundary of the Congo State, and on the outskirts of the Zombo country; while in the year 1899 another *posto* was established on the Kwangu river. We take these as sign sof good intentions, and hope for better things in the future.

It is important to remember that on the Congo, the immediate banks are populated by riverine tribes, who generally have little in common with the inland natives, and they act as middlemen between them and the white traders.

Noqui.—A traveller sailing up the Congo will find very few native towns on his journey. On the Portuguese side he will pass S. Antonio at the mouth, where there is a government-house and a Roman Catholic mission: then the flourishing trading stations of Kassanga, Mossuca, and Noqui, which is the principal port on the Portuguese side, and about ninety miles from the coast. Noqui has the name of being, with

[1] A paper read before the Geographical Section of the British Association Meeting in Glasgow.

Matadi (a few miles higher), the most unhealthy and deadly spot on the Congo, and for excessive heat and general discomfort it cannot easily be surpassed; and the death-rate among Europeans is very high. Commercially and politically, it cannot be dispensed with, as it is the receiving depôt for all places as far as the Kwangu river, a distance of about 300 miles. Most of the trading houses have their representatives here.

Noqui Hill.—Happy, however, is the man bound for the interior whose carriers are ready to take him out of this sweltering and swampy township: and although the famous "Noqui hill," with its rough boulders of rock and steep winding path, tests the soundness of one's respiratory organs, when the traveller looks down from the top, and finds Noqui 900 feet below him, he begins to feel more comfortable, and is glad of a cooler atmosphere to breathe in. When he has cast a final glance on the waters of the Congo, he begins to look around him for a friendly native town where he may spend the night: it is then that he wonders where the people are, for he can see nothing but bare rocks and tall, coarse grass, with here and there a few clumps of palms and small patches of green bushes in the well-watered ravines. He finally decides to pitch his tent by the first stream of water and camp for the night. Thus he gets on for two or three days through an exceedingly monotonous country, which is only relieved by an occasional stream or river. The roads are narrow tracks, and, except in the valleys, where one complains of the tall elephant grass, they are covered with loose quartz stones, which are very trying.

Mpozo River.—About the third day he crosses the Mpozo river, which empties itself into the Congo above Matadi, but at this point in the dry season its water only reaches to a little above the knee. Then come the Luzu and Lunda, with other lesser streams all joining the Mpozo. On the fourth day it is refreshing to come across some native towns, and to be able to buy fresh food for himself and carriers. As he nears S. Salvador, the country is more hilly, and he can see more ground under cultivation, a sure proof of the existence of more people; and when he consults his aneroid he finds that he has been gradually ascending, until he is now at S. Salvador, 1840 feet above the level of the sea.

S. Salvador.—Some two or three hundred years ago this ancient capital of the kingdom of Kongo must have been a large township. Cavazzi, Pigafetta, and others have given us their account of this great city in the wilds of Africa, where kings and their courts appear in great splendour, where churches were numerous, and where all the natives had embraced the Christian faith. Many of the statements of these eminent men must be taken with caution, but the fact remains that the ruins of several churches have been discovered, and the main arch of what is called "the cathedral" still stands in good state of preservation. The ruins of the city walls we have seen, but these are fast disappearing, for the stones are being dug up and used to erect government and other modern buildings. The arch of the ruined cathedral is the only remaining monument of a great and glorious past.

At present the whole population barely amounts to 1500, and the king has become little more than an ordinary chief—a tool in the hands of the government. There are two missions, one Roman Catholic and

one Protestant, and two trading firms have their agents there. Trade is small, and the only article of commerce is rubber. Now that the Government has established posts at Makela and the Kwangu, the trading houses prefer to send their agents there, so as to be nearer the native markets of the rubber-producing country. On this account S. Salvador is becoming less important every day.

Three years ago the committee of the Baptist Missionary Society decided to extend its operations into the Zombo country, and I was requested to undertake the work of prospecting, with a view to establish a mission station in the most populous and suitable district. I had spent over twelve years at S. Salvador previous to this, and had itinerated pretty extensively in several directions, and had learned something about Zombo. Hitherto, journeys made by European traders were confined to the northern region of Makela and along the frontier. The natives farther south were considered too dangerous for ordinary unarmed travellers to venture among, and I was accordingly warned by the Resident as to the danger of going unarmed.

I may be permitted here to mention that I never carry firearms, neither do I allow any of my carriers to do so. And I have never had any reason to regret it. My wife as usual accompanied me.

Map.—In the course of the past three years I have traversed the country between Zombo and S. Salvador by four different routes, which I have marked in a sketch-map of my itineraries. Only the places which came in my way and were carefully observed are put down on this map, which I look upon as a rough outline to be filled in on my return.

Luvu River.—Leaving S. Salvador by the Makela road we travel in an easterly direction, and cross the Luvu river twenty miles from the capital. Proceeding on our journey over a fairly level road we reach the foot of Bangu hill, and an hour's stiff climb brings us on to the plateau with an altitude of 3000 feet. It is here that the river Mbrizi falls over the precipitous rocks into the valley, the main leap being about 500 feet. This has been called the "Arthington falls," and is well known. There are two more falls a little to the south, the waters of which run into the Mbrizi. These I have seen from the Kimbubuzi hills, two days' journey to the south-east of S. Salvador, but as I had not then acquired the use of instruments, I was not able to locate them with any degree of accuracy. To all appearance they were equal in volume to the main stream.

Mbrizi River.—The river Mbrizi itself rises at a point four or five hours' march farther east, and bubbles up from the ground in a shady ravine 3300 feet above the sea. A mile or two from here is the highest point on the plateau, having an altitude of 3425 feet.

Kwilu River.—The most noticeable feature of these highlands is the numerous streams of clear crystal water everywhere. It is veritably a land of springs and rivers. The Kwilu and Mbrizi rise within a short distance from each other, the one winding its way northward to the Congo river, and the other runs south-west into the Atlantic.

Making our way eastward on the Makela road, we cross the Fulezi, and Loangu, and other lesser streams, all running north towards the

Congo; while on the route some miles farther south we find all the streams running south-west to join the Mbrizi.

Lufunde River.—Two days' journey over the plateaux brings us to a large valley through which runs the Lufunde river. Itself rising a little to the south of Makela, it is joined by multitudinous streams and rivulets precipitating themselves over the rugged and perpendicular rocks on both sides of the valley, providing the traveller with the pleasing sight of glittering waterfalls and comparatively wild scenery, which is most refreshing after the tedious monotony of grass and swamps. The Lufunde joins the Mbrizi towards the south-west, and is much the larger river of the two. Why the larger stream should lose its name and be known by that of the smaller is a mystery which I cannot explain. The valley varies in width from six to ten miles. It is very fertile, but unlike the higher levels it has its swamps and malaria.

Having climbed the hill on the eastern side we are once more on the plateaux, and after about an hour's march we notice the streams running east and north-east towards the Nkissi river. It is on this plateau, in the populous district of Kibokolo, that the Baptist Missionary Society opened a mission station two years ago about twenty miles to the south of Makela, in latitude 6° 17′ 20″ S., and longitude E. 15° 17′ 30″, exactly one degree east of S. Salvador. The character of the country continues the same until we reach the Nkissi valley, where at Kibulungu, the most eastern point of my itineraries, the river is 2500 feet above the sea. It is known here as the Malewa river. The whole valley is swampy in the extreme, and is constantly in flood during the rainy seasons. There are canoe ferries established by enterprising natives at various points. Nowhere in this part is the river fordable, and it is infested with crocodiles.

Climate.—There is very little one can add to what is already known of the climate. It is certain that the farther we are away from the larger rivers, and consequently from the swampy lowlands, the healthier it is for both Europeans and natives. The thermometer reads about 10° less at S. Salvador than at Matadi or Noqui, while on the Zombo highlands, the difference in the lightness of the atmosphere and the cold at night is most marked. I have only 18 months' meteorological record taken at our Kibokolo station. The average maximum temperature in the shade is 83·5 for the hot season, and 81·2 in the cold. The average minimum temperature shows 66·7° and 57·0° respectively. This makes an average *daily* difference of 20°.

Rain.—The rainfall for the past year at Kibokolo was 55·5 inches, which, if the natives can be relied upon, is below the average, while at S. Salvador the average fall is about 57 inches. The rainy season is from October to May.

Soil.—On the Zombo plateau the soil is very sandy, and the country is well drained; it is rarely one can find any stagnant pools of water. Indeed, this is a conspicuous feature of these highlands, which adds materially to the healthiness of the people, and more especially of the few Europeans there. From the point of view of health, this Zombo district is far preferable to any other in West Central Africa. Malarial fever has not been prevalent so far, the greatest danger being the liability to chills,

and great care is needed in the matter of clothing. However, the final verdict as to the healthiness of Zomboland must be given after further experience.

Flora.—These highlands would delight the heart of any botanist, and supply him with magnificent specimens. Around Kibokolo there is such a display of wild flowers and shrubs as I have not seen anywhere else—not the least pleasing to me being the large clusters of tree ferns which grow in profusion along the clear Lusengele stream close to our dwellings.

Population.—Some parts of Portuguese Congo are very sparsely populated, notably the districts near the banks of the Congo, and along the Kwangu river. The land is so little known that it is impossible to make any reliable estimate of its population. Zombo is decidedly far more thickly populated than any district I have yet visited on the Lower Congo—say from the Coast to Stanley Pool. In the Kibokolo group of towns, I estimate 5000 inhabitants, and there are similar groups all over the country.

Native Races.—The question of *Native Races* is growing to be one of the most important of all African problems. From the Cape to Cairo, and from Zanzibar to the Atlantic, there is no doubt but that the Africans are increasing very rapidly. There are districts which seem to have been devastated by the ravages of disease—especially of that terrible sleep sickness, which is the terror of the blacks, but this is local and temporary. It is only when we consider the terrible history of the African race that we can realise its wonderful vitality.

Slavery.—The Arab slave-raider has for ages worked his caravans to the coast, and sent shiploads of slaves across the seas, where they have to-day become a force which our American brothers find it difficult to stand against. Yet this continued exportation of its best blood has not destroyed the negro race.

Transport.—Another thing which has wrought havoc among the natives is the overland transport of goods and produce. It is surprising how many there are who succumb to this. The chiefs send their men on long journeys to the coast with heavy loads, and for the most part they live on raw cassava and palm nuts, while they sleep on the ground in the open at all seasons, with the result that many die on the journey, and more get sickly and die soon afterwards.

Wars, etc.—Then again, the tribal wars and murders, and the cruel superstitious customs of the natives themselves, have told against them. When we think of all this, it is a marvel that there is a man or woman left to tell the tale.

Drink.—The curse of intoxicating liquor has its own victims—not only the pernicious "fire water" imported from Europe, but the native concoction of cassava and millet beer, and fermented palm wine. In Zombo there is not much "gin" or "rum," but the drink kills its hundreds. And yet, in spite of it all, the people increase, and, in a sense, prosper.

A Change.—Things have changed considerably in later years. The export of slaves has been stopped, and although hundreds of natives are recruited on the "apprenticeship system" for the plantations on the islands—yet it is an improvement. We do not any longer see

the large chained gangs moving ponderously and slowly towards the coast along the old routes whose many towns retain still such names as "Vunda," and "Vemadia," marking the spots where the gangs rested at mid-day, and where the accompanying priest or priests sang their "Ave Marias" at evensong. What is done to-day is done in secret. Twice only have I seen chained slaves at S. Salvador, and those were immediately liberated on my reporting the cases to the Resident, a fact which I wish to put on record in acknowledgment of the ready assistance the Portuguese officials have rendered in these and other instances.

The days of the Arab slave-hunters are also numbered, and the sight of villages and districts laid waste by the sword and fire will not be so common as hitherto. The construction of railways, and the placing of steamboats on the inland lakes and rivers, will prove to be one of the most civilising forces in Central Africa. It will be a deathblow to slavery, and release the native from the degrading position of a beast of burden. Unfortunately, Portuguese Congo has very little to expect in this direction at present. Still it must come sooner or later.

Schools.—Another influence at work is the enlightenment which civilisation and Christianity bring in their train. Wherever schools are established, and the natives become educated, the cruel and murderous customs, and the barbarities of the people must disappear; and the thoughts of the natives be led to higher and better things than the killing of witches, and the destruction of slaves and women.

It is when we take into account these manifold forces at work in Africa to-day that we can form any conception of the wonderful vitality of the race and its possibilities for the future. Under these more favourable circumstances and enlightened ideas, the natives of Africa will increase rapidly, and the future of the Dark Continent will depend to a great extent on the way we deal with this all-important question. Unless this is wisely and firmly dealt with by a master hand, there will be much more trouble in store for us than that which confronts us to-day in the South African War.

Development.—The development of the country is proceeding more slowly in Portuguese Congo than in most parts, and for various reasons. What the mineral wealth of the country is I cannot say. We have heard of copper mines to the south of S. Salvador towards Ambrizette. The gold-hunter has been told that his precious metal is to be found in the same direction, but that the King of Kongo and his people are careful not to disclose its location. The old king, Don Pedro V., some ten years ago, was anxious to convince me that there was gold in his country, and one of his men, a friend of mine, was sent to procure a sample for me. The "nugget" was duly brought, and it certainly was golden in colour, and, in my absolute ignorance of the subject of minerals, I sent it home to England to be reported on, but the only gold discovered by the analyst was the one guinea which he got out of my pocket for his fee. I have taken no interest in Congo gold since then. The development of this part of Africa I believe must be in other directions than gold-mining, and I venture to submit that the resources of the country can only be developed by uplifting and developing the character of its people.

Produce.—To-day, from the coast to the Kwangu river, nothing of commercial value is obtained from the soil, and the cultivation of the ground is confined to the bare necessities of daily life. There are districts in Angola where cattle are reared and rubber cultivated. The Kongos and Zombos produce nothing for trade purposes. Much of the land is not suitable for rubber producing, but the soil is good and fertile, and could be used. Coffee grows well. Life among the natives is very primitive and their needs are few. There is no possible reason why the savage should do any hard work so long as he is satisfied with bare animal existence.

Labour.—The question of *forced labour* is a dangerous topic to introduce into a paper like this, but the longer I live and the more I know of the natives, the more confident I am that this policy is as unwise as it is revolting to the English idea of freedom. If we create new needs and cultivate new tastes among the savages, they will be compelled to cast aside their lazy habits, and engage in some definite and useful work. Such compulsion can only be an unmixed blessing to the people and to the country.

Missions.—It is here that Christian Missions are doing a work in Africa which cannot fail to be recognised by those who have little sympathy with their spiritual work. Schools have been established, and in the neighbourhood of S. Salvador alone hundreds of natives can read and write. Literature has been provided for them in the vernacular, and their minds have been enlightened and stimulated, so that they no longer satisfy themselves with the old savage life, but dress themselves decently; and, instead of filthy grass huts, they want better houses, they demand better food—more comforts, and some kind of a home life. Some of the younger educated men at S. Salvador have built themselves houses far more comfortable and imposing than that in which the Portuguese Resident has lived in for years. All this means higher ambitions and greater needs; and whoever aims at this higher civilisation must needs shake himself free from the sloth and inactivity of the African savage, and apply himself diligently to higher things.

Industrial Training.—In connection with our Mission, we have trained a number of young men as carpenters, bricklayers, stonemasons, and blacksmiths, who now occupy positions as skilled artisans at various trading companies. Also they are employed by the government and the railway company.

Church Building.—Two years ago we completed the erection of a large church, 70′ × 40′, which we consider to be one of the best buildings anywhere in that part of Africa. It is built of stone chiefly obtained from the ruins of an old convent, and the timber used for the roof and rostrum is all local. All the work has been done by the native lads trained at S. Salvador, and under my supervision; and not only no stranger's hand ever touched the work, the whole of the cost has been defrayed by the natives themselves.

Conclusion.—This industrial training, together with schools and literature, is calculated to lift up the African from his depth of degradation and slothfulness, and fit him to take his place as a responsible being in the progress and development of his own country.

This is not the place to discuss the yet higher aspects of his mental

and spiritual development which the Christian missionary has first and foremost in view: suffice it to know that in a purely secular sense we have been able to contribute something towards the opening up of the Dark Continent to the invaluable blessings of civilisation and progress.

THE CLIMATOLOGY OF AFRICA.

TENTH AND FINAL REPORT OF A COMMITTEE CONSISTING OF MR. E. G. RAVENSTEIN (*Chairman*), DR. H. R. MILL, AND MR. H. N. DICKSON (*Secretary*). (*Drawn up by the Chairman.*)

METEOROLOGICAL returns have been received by your Committee in the course of last year from twenty-one stations in Africa, including Asiut and Omdurman; Old Calabar; Blantyre, Lauderdale, Fort Johnston, and Nkata Bay in Nyasaland; Kisimayu, Malindi, Lamu, Takaunga, Mombasa, and Shimoni on the coast of British East Africa; Machako's, Kitui, Nairobi, and Kikuyu in the interior of that Protectorate; and from the four lake stations in Buganda. We are, moreover, enabled to give the results of seven years' observation on the rainfall at Mengo (Buganda), taken from the unpublished journal of the late Mr. A. M. Mackay. A table giving the rainfall since 1890 at a number of stations has been added.

Since the appointment of your Committee in 1891 meteorological reports from as many as seventy-one African stations have been published through its agency, and it may safely be asserted that many of the more valuable of these observations would never have been made or become generally available had it not been through our action. Amongst these stations, however, there are only fifty-six the records of which embrace a full year, and eleven from which we have received full returns for at least five years. These latter are Lauderdale, Dunraven (rainfall only), Kisimayu, Malindi, Lamu, Takaunga (rainfall only), Mombasa, Chuyu (or Shimoni in Wanga), Machako's, Fort Smith (in Kikuyu), and Mengo (Namirembo and Natete). Among stations having a less extended record, but distinguished for the care with which the observations were taken and the interest attaching to the results, are Bolobo in the Congo State ($3\frac{3}{4}$ years); Zomba (4 years), and Fort Johnston (28 months) in Nyasaland; Kibwezi (18 months) in British East Africa and Old Calabar. We should also refer here to the high value attaching to the observations on the lake level of Victoria Nyanza.

A summary of Dr. Livingstone's meteorological work during his last journey (1866-71) will be found in our Report for 1894.

In *Egypt* Major Lyons, Director-General of the Survey Department, is gradually pushing meteorological stations into the Sudan.

In *Nyasaland* the scientific department organised by Sir H. Johnston, and placed in charge of Mr. M'Clounie, an able and zealous officer, who during a recent visit to Europe has availed himself of opportunities offered to gain a competent knowledge of the working of a thoroughly equipped meteorological observatory. Zomba, the headquarters of the

Protectorate, will soon take its place among stations of the first order, for it is now furnished with a thermograph, a barograph (specially designed for a considerable altitude), an anemometer, and a Whipple-Casella sunshine recorder. Fort Johnston ranks as a station of the second order, and it is proposed to establish similar stations at Chinde and at one of the lake ports. In addition to Lauderdale, where the representatives of Mr. J. W. Moir continue his work, Zomba and Fort Johnston, there are ten climatological stations, and rain-gauges have been set up in many places. Quite recently ten hygrometers have been ordered, for, as Mr. M'Clounie writes, "cacao is to be experimented with, and to think of growing such a product anywhere we must have some idea of humidity and saturation." The registers are kept in conformity with our *Hints*. The results are published monthly in full as a supplement to the *British Central Africa Gazette*, and freely distributed.

In *British East Africa* instruments were supplied in 1891 by the late Imperial British East Africa Company, and it does not appear that fresh grants have been made since or breakages made good. The earlier records appear to have been lost, but a summary of all that could be saved up to 1893 has been published by the Chairman of your Committee.[1] All that has been done since will be found in the "Reports" of your Committee, the original "Registers" having been kindly communicated by the Foreign Office.

In July 1895 Dr. A. D. Mackinnon proposed to H.M. Commissioner for *Buganda* the establishment of at least three fully equipped meteorological stations, there existing at that time throughout the Protectorate only two rain-gauges, in addition to a few instruments in the hands of the missionaries. These sets, including mercurial barometers and anemometers, were granted by the Foreign Office in May 1896, and supplementary grants have been made since. When Sir H. H. Johnston arrived at the close of 1899 he found Mr. Alexander Whyte at the head of a scientific department, and he induced the Foreign Office to appoint an assistant (Mr. J. Mahon), who should attend more particularly to the collections and the tabulation of meteorological information. Meteorological stations have now been established at Naivasha, Baringo, Eldoma Ravine, Kisumu, Mumias, Jinja, Fort Thruston, Kampala, Ntebe, Fort Stanley (Sese Islands), Masaka (Buddu), Fort Portal (Toro), Mbarara (Ankole), Hoima (Unyoro), Wadelai, and Gondokoro.

Such of the instruments originally issued by us which have not become unserviceable, been lost, or been otherwise disposed of, have been left in the hands of trustworthy observers, with a reversionary claim upon them by the British authorities within whose territory the stations are situated.

Your Committee have likewise published *Hints to Meteorological Observers in Tropical Africa*, which, they are happy to say, have been made widely known and freely accepted by observers. Copies may be obtained on application to the Secretary of the Royal Meteorological Society.

The registers received by your Committee, and not claimed by the observers, have been handed over either to the Meteorological Council

[1] *Report on Meteorological Observations in British East Africa for 1893.* London: G. Philip and Son, 1894. Persons interested can have copies gratis on application.

or to the Secretary of the Royal Meteorological Society, and may be freely consulted by persons interested.

Your Committee are under no illusion as to the merely conditional value of many observations published by them. The index errors of the instruments were unknown in many instances; the hours for making observations were injudiciously chosen; the observers, owing to illness or official duties, were frequently unable to fill up the registers, and there was no one to take their place; or, worse still, they had absolutely no knowledge of the manner in which the instruments intrusted to them should be handled, and placed readings on record which, on the face of them, are utterly absurd,[1] and must unhesitatingly be rejected.

Your Committee, on bringing their ten years' service to a close, desire to direct the attention of the authorities called upon to organise the meteorological service in British Protectorates or Crown Colonies to the following points:—

1. The instruments supplied should not only be verified before they leave England, but should also be inspected periodically by a competent official, who would pay particular attention to their exposure, inquire into the competency of the persons charged with filling in the registers, and eventually teach them how to observe.

2. Inasmuch as all officials may occasionally be called upon to fill up the registers, they should be instructed, before they leave England, in handling and reading the usual meteorological instruments. An hour spent at the office of the Meteorological Council, or with the Secretary of the Royal Meteorological Society, would suffice for that purpose.

3. It is of far greater importance to have a limited number of stations well equipped, and the registers from which can be thoroughly trusted, than a multiplicity of stations provided with defective instruments, carelessly or intermittingly attended to.

4. Care should be taken that there should be no interruption in the records kept at the principal stations owing to the illness or temporary absence of the observer. Duly qualified native assistants could be obtained from the Meteorological Department of India.

5. It is most desirable that the hours of observation recommended in our *Hints* should be strictly adhered to, not for the sake of uniformity only, but mainly because they yield a true mean of barometric pressure, temperature, and humidity without making undue or unreasonable demands upon the time of the observers.

6. Unless local provision is made for the adequate publication of the observations, the registers should be forwarded (through the Foreign or the Colonial Office) to the Meteorological Council, or to the Secretary of the Royal Meteorological Society, in order that abstracts may be prepared and made generally accessible to meteorologists and others interested. Still better would it be if an annual volume containing all these observations were to be published separately.

[1] Not infrequently, as pointed out by us in publishing these observations, the wet bulb and maximum thermometers give higher readings than the dry bulb and minimum thermometers. Nay, some of these observers seem to be ignorant of the decimal notation, for they enter 17·8 or 30·68 when there is no doubt that 17·08 and 30·068 ought to have been entered.

Asiut (*Egypt*), *Lat.* 27° 11′ *N.*, *Long.* 31° 13′ *E.* *Height of Barometer above Sea-level* 55·6 *m.* *Abstract of Monthly Return, Published by Major J. S. G. Lyons, R.E., Director-General of Survey Department, Cairo.*

Month	Mean Atmospheric Pressure.	Temperature (Celsius)					Relative Humidity				Vapour Pressure				Cloud 0-10 Mean	Prevailing Wind			Rain		Evaporation
		Mean Max.	Mean Min.	Mean	Extremes Max.	Extremes Min.	6 A.M.	2.30 P.M.	9 P.M.	Mean	6 A.M.	2.30 P.M.	9 P.M.	Mean		6 A.M.	2.30 P.M.	9 P.M.	Amount	Days	
1900	mm.						P.c.	P.c.	P.c.	P.c.	mm.	mm.	mm.	mm.					mm	No.	mm.
May . .	758·8	38·7	20·2	29·0	46·0	15·0	38·0	14·0	22·0	24·0	11·7	13·6	13·1	12·8	2·9	NW.	NW.	NW., NE.	0	0	
June . .	757·0	38·4	24·6	30·5	47·5	17·5	47·3	13·8	23·0	28·0	14·0	17·8	15·4	16·1	2·7	NW.	NW.	NW.	0	0	462
July . .	753·9	38·3	23·3	31·0	44·0	14·0	42·0	16·6	24·0	30·9	12·3	7·8	8·3	9·5	0·1	NW.	NW.	NW.	0	0	
							8 a.m.		9 p.m.		8 a.m.		9 p.m.			8 a.m.		9 p.m.			
August . .	754·6	35·7	23·1	30·1	42·5	22·0	48	—	42	—	13·2	—	13·5	—	0·2	NW.	—	NW.	0	0	—
September .	757·5	32·7	20·3	26·2	36·0	18·0	66	—	55	—	13·0	—	14·3	—	0·5	NW.	—	NW., NE.	0	0	
October . .	759·6	30·7	17·7	23·7	36·5	14·0	71	—	—	—	13·5	—	—	—	—	NW.	—	NW.	0	0	362
November .	760·4	27·3	11·4	19·3	34·0	7·0	71	—	67	—	10·0	—	9·9	—	1·0	NW.	—	NW.	0	0	280
							8 a.m.	2.30 p.m.	9 p.m.		8 a.m.	2.30 p.m.	9 p.m.			8 a.m.	2.30 p.m.	9 p.m.			
December .	761·2	22·1	8·3	15·3	28·0	3·0	78	46	70	65	7·8	7·8	8·0	7·9	3·5	NW.	NW.	NW.	0	0	126
1901																					90
January . .	760·1	19·9	4·6	10·1	23·0	0·5	73	36	68	66	6·4	7·6	6·4	6·8	2·7	NW.	NW.	NW.	0	2	86
							8 a.m.	2 p.m.	8 p.m.		8 p.m.	2 p.m.	8 p.m.			8 p.m.	2 p.m.	8 p.m.			
February .	760·5	27·0	8·0	14·0	34·0	5·0	73	35	61	54	8·9	8·1	8·3	8·3	1·1	NW.	NW.	NW.	0	0	118
March . .	758·1	32·3	10·9	19·1	42·5	4·0	49	21	49	43	8·1	6·7	8·1	7·6	1·8	NW.	NW.	NW.	0	0	226
April . .	758·1	32·6	14·8	23·5	44·0	10·0	50	21	33	33	8·2	6·6	7·7	7·5	7·5	NW.	NW., NE.	NW.	0	0	201
May . .	756·3	34·4	17·7	26·0	44·0	13·0	36	19	28	28	8·4	7·0	7·1	7·5	3·1	NW., NE.	NW	NW.	0	0	333
Year (June to May) .	758·9	31·4	15·1	23·2	47·5	0·5	60	—	48[1]	—	9·3		3·8[1]		2·1[1]	NW.	NW.	NW.	0	0	

Asiut. The mean temperature from May to July 1900 is deduced from the formula $\frac{6 + 2\,30 + 9 + 9}{4}$; that from August to the end of the year from the formula $\frac{\text{Max.} + \text{Min.}}{2}$; that since January 1901, from the formula $\frac{8 + 2 + 8 + \text{min.}}{4}$.

The Barometric Pressure has been reduced to 0° C., to sea level and to latitude 45°. The means, however, are merely approximate, having been deduced from observations made twice or thrice daily, at 8, 2.30, and 9, or at 8, 2 and 8, or at 8 and 9, or at 8 a.m., 2.30 p.m., and 9 p.m. (May to July, December and January), 8 a.m. and 9 p.m. (August to November), or 8 a.m., 2 p.m., and 8 p.m. (since February).

There is a self-recording aneroid at the station, as also a Thermograph, but the records of the latter seem to be untrustworthy.

The Humidity for December to May is in all probability greater than stated above.

[1] Partly estimated.

Omdurman (Sudan), Lat. 15° 28′ N., Long. 32° 30′ E. Height of Barometer above Sea-level 376 m. Abstract of Monthly Returns. Published by Major J. S. G. Lyons, R.E., Director-General of Survey Department, Cairo.

Month	Monthly Mean Atmospheric Pressure.	Temperature (Celsius)					Relative Humidity			Vapour Pressure			Cloud 0-10 Mean	Prevailing Wind			Rain		
		Mean Max.	Mean Min.	Mean	Extremes Max.	Extremes Min.	8 A.M.	2.30 P.M.	9 P.M.	8 A.M.	2.30 P.M.	9 P.M.		8 A.M.	2.30 P.M.	9 P.M.	Amount	Days	Hundredths Inch
1900	mm						P.c.	P.c.	P.c.	mm	mm	mm.					mm	P.c.	Inch.
July (8-31)	723·6	25·9	24·5	29·8	39·0	21·1	71	37	58	17·8	14·3	17·2	5·2	SW., S.	S., SW.	S., SE	80·0	4	3·14
August	724·1	35·7	23·3	29·9	39·0	18·9	76	39	61	18·6	15·7	18·9	3·7	SE., S.	SE.	S., SE	56·4	5	2·22
September	724·0	38·2	24·8	32·7	42·0	21·1	67	35	54	17·3	14·3	17·0	2·2	SW., NW.	S., SE.	SE., S.	22·5	2	0·89
October	723·7	39·6	24·3	32·4	42·0	18·3	41	17	26	10·5	8·6	9·2	0·9	NE., N.	NE.	NE.	7·6	2	0·3
November	725·0	35·5	20·8	25·9	41·0	16·1	29	15	18	5·3	6·1	5·1	0·6	N.	NE., N.	N.	0	0	
December	726·3	30·2	17·9	23·1	36·0	13·0	31	22	23	4·8	6·3	5·1	1·1	N.	N., NW.	N.	0	0	..
1901							8 a.m.	2 p.m.	8 p.m.	8 a.m.	2 p.m.	8 p.m.		8 a.m.	2 p.m.	8 p.m.			
January	726·6	28·0	17·0	22·5	38·0	12·0	28	17	21	4·2	5·2	4·8	0·8	N.	N., NE.	N., NW.	0	0	..
February	721·4	31·7	21·2	26·3	39·0	14·0	34	15	21	7·1	5·8	5·8	0·1	N.	NE., N.	N.	0	0	.
March	723·2	37·6	.	27·7	42·0	..	23	14	15	6·0	6·4	5·2	0·6	NE., N.	NE., N.	N., NE.	0	0	0
April	722·5	39·8	.	29·8[1]	44·0	..	17	15	12	4·6	6·4	4·6	1·1	NNE., NE.	NE., N.	NE., NW.	..		
May	721·8	42·4	26·1	33·9	44·0	18·0	21	14	15	8·45	7·38	6·70	1·0	NNE., S.	NE., N.	NE., N., NW.	6	0	.

Omdurman.—The Barometric Pressure has been reduced to 0° C., but not to the sea-level or lat. 45°.

The mean temperature up to December is deduced from the formula $\frac{6+2\times 3+9}{4}$; that beginning with January 1901, from the formula $\frac{8+2+2}{4}$ mm

[1] Estimated.

Old Calabar. Lat. 4° 58′ W., Long. 8° 17′ E. Observers: Dr. E. G. Fenton and Dr. Robert Bennett.

Month	Barometer	Temperature: Mean Max.	Mean Min.	Mean	Extremes: Max.	Extremes: Min.	Relative Humidity	Vapour Pressure	Rain: Amount	Rain: Days	Rain: Heaviest Fall	Harmattans	Tornadoes
1900	In.						p.c.	In.	In.	No.	In.	No.	No.
June	30·08	87·9	72·2	80·8	92	71	84·4	·836	32·59	22	5·01	..	6
July	30·10	82·9	75·9	77·9	90	70	85·8	·801	13·61	25	1·95	..	1
August	·09	81·1	72·0	77·1	86	70	88·2	·808	6·59	15	1·35	..	..
September	·07	84·9	73·1	80·8	92	70	85·7	·820	14·84	25	2·29	..	..
October	·01	88·4	73·9	82·3	91	70	82·6	·793	9·38	17	2·24	..	5
November	·00	88·3	72·6	82·8	91	71	83·9	·863	11·34	12	3·32	..	3
December	29·99	87·0	73·6	81·9	89	70	82·6	·812	1·32	1	1·32	14	1
1901													
January	29·99	88·0	71·7	83·4	90	68	78·8	·784	2·68	1	2·68	10	1
February	·99	91·3	74·3	86·5	94	72	78·4	·834	0·69	5	0·23	..	2
March	·96	90·2	74·2	84·8	94	71	81·6	·863	7·70	8	2·25	..	1
April	·98	90·9	75·6	85·5	95	71	75·8	·858	11·01	10	3·31	..	6
May	30·00	90·0	75·9	81·9	94	75	77·6	·814	16·95	19	2·97	..	5
Year	30·02	87·6	73·5	82·2	94	68	82·1	·824	119·50	150	5·01	24	37

The mean temperature has been deduced from the formula $\frac{7+1+9+9}{4}$, the mean pressure and humidity from the formula $\frac{7+1+9}{3}$.

The observations in other respects are published as received.

The relative humidity at 7 a.m. was 91·0 p.c., at 1 p.m. it was 68·1 p.c., at 9 p.m. 87·2 p.c. The extremes noted were 33 p.c. on January 27 and 95 p.c. in May.

Lauderdale, Mlanje. Lat. 16° 2′ S., Long. 35° 30′ E., 2540 feet. Communicated by John W. Moir.

Month	Mean Temperature: 6 A.M.	9 P.M.	Max.	Min.	Mean	Temp. Extremes: Highest	Lowest	Mean Temp. Wet Bulb: 6 A.M.	9 P.M.	Dew Point: 6 A.M.	9 P.M.	Vapour Pressure: 6 A.M.	9 P.M.	Relative Humidity: 6 A.M.	9 P.M.	Rain: Amount	Days	Highest Fall	Cloud (0–10): 6 A.M.	9 P.M.
1900												In.	In.	p.c.	p.c.	In	No.	In.		
January	69·7	72·3	78·5	67·3	72·9	87·8	60·0	67·5	69·3	66·5	68·1	·650	·685	90	86	19·23	26	4·86	7·2	6·3
February	67·2	71·3	80·3	65·4	72·8	89·5	64·2	65·0	67·3	63·2	65·5	·592	·627	87	87	9·65	16	2·24	6·7	5·3
March	67·4	72·5	81·6	65·7	73·6	87·5	61·1	65·2	67·6	64·2	65·4	·599	·625	89	79	18·89	16	4·21	6·6	4·4
April	65·2	70·3	78·0	64·9	71·4	87·9	58·0	62·0	64·4	60·3	61·4	·523	·544	84	73	6·74	6	2·35	3·1	2·4
May	63·4	66·5	74·2	59·3	66·7	79·9	55·3	60·6	62·5	59·0	60·5	·500	·525	85	81	6·60	13	2·15	0·5	3·5
June	59·3	62·4	69·9	55·0	62·5	76·2	49·6	55·3	57·6	52·9	60·5	·397	·426	79	93	2·22	8	0·74	3·1	4·0
July	58·8	64·0	71·8	56·5	63·7	75·3	51·4	55·1	57·9	54·9	54·1	·386	·418	78	70	0·67	3	0·44	2·4	2·6
August	62·0	67·0	72·5	56·4	64·5	76·9	50·1	57·2	59·4	54·2	47·4	·420	·327	77	56	2·20	3	1·25	2·2	1·7
September	60·6	68·4	76·2	56·6	66·4	85·1	52·0	56·9	60·1	54·6	55·1	·426	·435	81	62	3·11	2	2·75	0·9	1·4
October	70·5	77·7	88·8	63·1	76·9	95·2	57·0	64·5	65·2	61·1	58·7	·537	·494	72	52	2·82	2	2·37	2·4	1·3
November	70·7	74·5	83·7	65·6	74·7	94·3	60·0	66·3	67·8	64·3	64·7	·601	·611	80	71	8·94	9	5·44	3·7	4·0
December	69·7	72·1	80·7	66·3	73·5	88·5	62·0	67·4	68·3	66·4	66·7	·647	·653	89	80	12·52	15	2·62	5·3	5·1
Year 1900	64·5	69·9	78·0	61·9	69·9	95·2	49·6	62·0	64·0	59·9	60·7	·523	·531	82	74	93·59	119	5·44	3·7	3·2
.. 1899	65·8	67·8	76·5	61·6	69·0	99·8	49·2	49·2	67·3	58·7	60·3	·504	·529	84	77	128·14	182	8·56	4·2	4·5
.. 1898	63·8	68·9	78·0	62·8	70·4	95·0	51·2	51·2	68·6	59·6	61·2	·518	·547	87	77	158·87	207	3·67	4·9	4·1
,, 1897	..	..	81·6	62·0[1]	71·8	99·1	47·3	..	..	..	..	..	..	..	..	79·01	157	3·98	4·7	..
,, 1896	64·5	68·8	80·2	62·7	71·4	100·4	51·0	..	..	..	..	..	..	..	..	108·15	161	5·07	3·1	3·5
,, 1895	63·9	68·7	78·4	63·0	70·2	98·8	51·5	60·5	64·0	58·4	61·7	·494	·552	82	78	131·72	194	12·41	..	..
Mean, 1896-1900	..	..	78·9	62·2	70·5	97·9	49·7	..	..	..	..	..	..	..	..	113·55	165	6·55	4·1	..

[1] The mean temperature is assumed to be the mean of the max. and min. temperatures, and is about 1° too high.

Fort Johnston, Nyasaland. Lat. 14° 28′ *S., Long.* 35° 15′ *E., Alt.* 1590 *feet approx.*

Month.	Barometer (corrected for index error only)	Mean Temp. Mean Max.	Mean Min.	Mean	Temp. Extremes Highest	Lowest	Dew Point	Vapour Pressure	Relative Humidity	Rain Amount	Rain Days	Heaviest Fall	Cloud (0-10) Mean	Sunshine
1898	In.							In.	P.c.	In.	No.	In.		Hrs.
January	28·469	87·5	71·7	77·8	92·9	67·5	72·8	·806	83	7·54	23	1·14	6·7	..
February	·489	89·7	69·2	75·7	91·9	66·8	69·7	·724	79	8·68	14	2·23	6·7	..
March	·493	87·9	69·5	76·1	94·5	65·5	71·4	·769	84	6·89	18	1·77	6·6	..
April	·559	84·6	65·9	73·2	94·7	60·0	67·4	·678	82	6·15	13	3·46	5·4	..
May	·625	84·2	60·2	71·2	90·9	54·6	62·2	·560	75	0·11	1	0·11	3·1	..
June	·723	78·4	57·7	66·7	89·7	51·4	57·9	·434	71	0·47	6	0·14	6·2	..
July	·724	79·4	56·7	66·3	87·5	51·8	56·5	·456	71	0·02	2	0·01	5·4	..
August	·707	81·3	56·2	67·2	90·0	49·4	55·2	·436	69	0·27	3	0·14	4·9	..
September	·605	89·7	61·7	74·8	96·0	53·5	62·0	·556	65	0·04	1	0·04	3·8	..
October	·531	96·9	65·4	81·1	105·9	60·0	67·2	·665	62	0·42	2	0·24	3·0	..
November	·470	99·3	71·8	82·9	105·8	66·8	65·6	·708	62	2·06	7	0·81	6·7	..
December	·485	93·6	69·0	80·9	105·0	64·0	69·8	·726	69	9·56	17	1·72	2·3	..
Year 1898	·573	87·5	64·5	74·4	..	..	64·7	·627	73	42·01	107	2·23	5·5	..
1899														
January	28·502	93·6	67·3	79·2	100·9	62·1	69·5	·715	71	1·80	8	0·72	4·7	247
February	·448	88·7	67·6	79·5	100·2	64·3	70·7	·748	76	12·17	20	3·33	8·8	109
March	·500	90·1	66·4	79·4	97·0	63·0	70·3	·741	79	6·46	15	1·40	4·8	246
April	..	86·5	65·1	..	93·0	59·0	..	..	..	3·13	9	1·27	..	260
May	..	82·8	60·9	..	85·0	49·0	..	..	..	0·38	6	0·10	..	202
June	..	77·5	53·5	..	80·0	49·0	..	..	..	0·04	1	0·04	..	..
July	..	81·8	56·1	..	86·0	54·0	..	..	..	0·00	0	..	..	..
1900														
January	28·810	91·4	68·3	80·5	98·0	66·0	74·6	·858	81	11·37	20	2·34	5·7	..
February	·856	91·4	67·1	77·9	98·0	63·5	72·9	·809	79	3·65	10	1·10	5·2	..
March	·878	92·5	67·3	81·6	99·0	64·0	72·5	·798	75	2·57	11	0·69	4·0	..
April	·922	91·3	65·1	80·7	95·0	62·0	71·8	·779	74	0·07	3	0·01	2·3	..
May	·948	89·5	62·6	79·5	93·0	58·0	70·3	·743	73	0·17	2	0·15	3·0	..
June	29·045	83·4	56·1	72·5	90·0	52·0	64·0	·598	71	0·01	1	0·01	3·0	..
October	28·531	101·8	65·2	..	105·2	59·1	..	..	..	0·00	0	..	2·4	303
November	·532	96·9	72·8	82·1	104·7	65·8	70·2	·741	64	2·86	10	0·65	3·8	269
December	·497	93·9	68·0	80·2	99·1	61·8	71·5	·783	74	5·47	..	1·25	4·2	279

Fort Johnston. The mean temperature is deduced from the formula $\frac{7+2+9-9}{4}$; the humidity from $\frac{7+2+9}{3}$.

The barometer is corrected for index error but not reduced to 32° F.

Nkata Bay, Nyasa. Lat. 11° 37′ 5″ *S., Long.* 34° 18′ *E., Alt.* 1645 *feet.*

Month	Mean Temperature	Rain	Sunshine (estimated)
1900		In.	Hrs.
January	75·4	11·56	165
February	76·1	8·48	187
March	74·6	16·31	210
April	73·1	6·12	198
May	72·0	4·53	257
June	69·8	2·68	221
July	67·8	0·78	272
August	70·3	·33	294
September	72·9	·05	[310]
October	77·8	·00	333
November	81·8	·26	260
December	80·2	11·93	248
Year 1900	74·2	62·87	2,889
,, 1899	74·1	60·30	2,884
,, 1898	72·4	90·72	2,834

Nkata Bay. The mean temperature is deduced from the formula $\frac{7+2+9+9}{4}$. The totals and means are taken from Mr. J. M'Clounie's Summary Table.

Note to following Table.

Blantyre. The above is taken from Mr. J. M'Clounie's Summary Table.

Blantyre, African Lakes Corporation's Gardens.

Month	Mean Temp. Max.	Mean Temp. Min.	Rain
1898			In.
July	67·4	51·0	0·43
August	68·8	48·3	·18
September	79·0	54·0	·99
October	90·9	62·0	·37
November	89·0	66·4	3·45
December	84·0	62·1	12·31
1899			
January	82·0	62·4	4·91
February	78·7	64·0	12·47
March	78·6	61·0	9·45
April	80·0	60·0	3·39
May	77·1	53·6	1·81
June	74·1	49·0	0·74
July	74·0	48·4	·05
August	..	..	·00
September	85·0	51·6	·00
October	90·5	60·5	·83
November	84·4	62·4	5·17
December	85·0	61·2	6·24
Year 1899	..	..	47·56
1900			
January	81·5	63·0	11·63
February	82·7	61·3	5·73
March	86·2	61·0	5·10
April	87·5	59·0	0·10
May	81·5	56·0	·51
June	85·3	51·0	·25
July	82·0	48·0	·00
August	..	..	·00
September	88·2	51·7	·00
October	92·6	61·0	·00
November	..	..	9·80
December	..	..	6·38
Year 1900	..	..	39·65

Mombasa. Lat. 4° 4′ S., Long. 39° 42′ E., 60 feet. Observer: J. W. Tritton.

Month	Pressure of Atmosphere 9 A.M.	Mean Temperatures					Temp. Extremes		Daily Range	Humidity, 9 A.M.			Rain			Cloudy days (Sundays excluded)
		Dry 9 A.M.	Wet 9 A.M.	Mean Max.	Mean Min.	Mean 9 A.M.	Highest	Lowest		Dew Point	Vapour Pressure	Relative Humidity	Amount	Days	Heaviest fall	
1900	In.										In.	P.c.	In.	No.	In.	No.
January	29·831	82·0	80·8	87·6	82·5	84·7	88	80	4·5	79·8	1·015	93	4·09	7	1·05	17
February	·846	84·0	82·8	87·5	82·7	85·1	90	70	4·8	82·2	1·096	94	2·23	5	1·05	11
March	·874	84·0	83·3	87·7	83·1[1]	85·4[1]	98	60[1]	4·6[1]	82·8	1·120	95	6·62	11	2·22	13
April	·879	85·3	83·6	87·7	85·3	86·5	90	82	2·4	83·1	1·139	94	2·64	8	1·35	5
May	·928	81·8	81·0	84·5	81·5	82·9	87	80	3·0	81·5	1·074	96	18·07	15	5·10	6
June	·946	79·7	78·1	82·4	80·3	81·3	84	79	2·1	77·5	0·942	95	2·53	10	0·80	10
July	·963	78·9	77·2	81·9	80·1	81·0	86	79	1·8	76·6	·913	95	6·13	15	1·12	9
August	·959	79·2	77·5	81·4	80·9	81·1	83	79	0·5	76·9	·922	95	1·45	5	0·50	5
September	·947	80·7	79·2	82·8	82·2	82·5	85	81	0·6	79·0	·988	98	2·34	8	1·05	2
October	·870	81·8	80·2	83·4	82·9	83·2	85	81	0·5	79·7	1·011	95	6·22	9	1·83	5
November	·817	83·2	81·6	85·1	83·5	84·3	88	81	1·6	81·1	1·059	95	5·44	9	1·65	6
December	·786	83·5	81·4	85·4	84·2	84·8	87	82	1·2	80·8	1·047	94	3·86	8	1·07	10
Year 1900	29·887	82·2	80·5	84·7	81·2	83·0	98	60	3·5	80·0	1·026	95	61·56	114	5·10	99
,, 1899	·911	81·7	79·4	85·9	78·6	82·3	90	73	7·3	78·5	·974	90	35·16	94	2·78	..
,, 1898	·889	81·4	78·5	84·5	76·2	80·3	87	69	8·4	75·9	·946	88	25·00[3]	39	2·50	..
,, 1897	·904	80·7	77·0	83·2	75·4	79·3	88	71	7·8	75·6	·886	85	52·56	42	5·50	..
,, 1896	·906	80·3	75·6	82·9	75·8	79·3	89	70	7·1	73·8	·832	81	65·24	94	4·31	..
Mean, 1896–1900	29·899	81·5	78·1	84·2	77·4	81·4	90	71[2]	6·8	77·92	·9092	862	47·92	77	5·10	..

Mombasa.—All readings have been corrected for instrumental error, excepting those of the barometer, the records of which have, however, been reduced to 32° F. and to standard gravity in Lat. 45°.

[1] The readings of the minimum thermometer during March should be rejected. On 10 days the max. and min. temperature is stated to have been the same, and on 4 days the min. temp. is entered as having exceeded the max. temperature. It is probable that the wet-bulb readings for several years past have been too high.

[2] Omitting the year 1900.

[3] Partly estimated.

Shimoni (Wanga). Lat. 4° 38′ S., Long. 39° 21′ E. Observers: M. G. Carvalho, E. H. L. Murray, and the late E. H. Russell.

Month	Atmospheric Pressure		Mean Temp. 9 A.M.		Humidity 9 A.M.			Rain		
	9 A.M.	3 P.M.	Dry	Wet	Dew Point	Vapour Pressure	Relative Humidity	Amount	Days	Heaviest fall
1900	In.	In.				In.	P.c.	In.	No.	In.
January	29·882	29·818	84·4	81·2	80·2	1·028	90	2·85	8	1·20
February	·865	·813	84·5	82·5	81·9	1·087	94	·80	2	·70
March	·909	·813	84·4	82·3	81·6	1·078	94	3·16	7	1·87
April	·908	·811	81·4	79·5	78·2	·984	94	2·98	9	1·50
May	·914	·815	79·0	77·4	76·8	·921	95	21·15	25	4·92
June	·957	·860	76·3	74·9	74·4	·848	95	4·47	11	1·15
July	30·029	·966	76·6	75·1	74·5	·853	95	5·06	21	1·20
August	·041	·970	75·9	74·8	74·5	·853	97	2·82	16	·50
September	·010	·969	76·5	76·4	76·0	·897	99	2·45	8	1·45
October	29·979	·920	79·0	77·8	77·4	·938	96	3·69	8	·75
November	·906	·845	80·9	79·8	79·4	1·003	98	8·06	12	3·00
December	·878	·835	81·1	80·0	79·6	1·010	98	1·85	15	·39
Year 1900	29·940	29·878	80·0	78·5	77·9	·958	95	59·76	120	4·92
,, 1899	·945	·879	76·6	75·7	77·0	·927	92	52·51	91	4·60
,, 1898	·901	..	80·7	79·1	78·5	·974	93	27·30	85	2·80
,, 1897	·788	..	81·0	79·1	79·3	·977	92	56·75	109	4·60
,, 1896	·805	..	80·1	76·5	75·2	·874	85	56·57	111	5·25
Mean, 1896–1900	29·875	..	79·7	78·2	77·6	·942	91	46·56	103	5·25

Shimoni.—All readings have been corrected for instrumental error (see Report for 1898, p. 4). The dry bulb readings are those of the thermometer attached to a barometer.

The barometer readings have been reduced to 32° F. and Lat. 45°, but not to sea-level.

Lamu. Lat. 2° S., Long. 40° E. Observers: A. S. Rogers, Wallace Blake, J. J. Anderson.

Month	Mean Temp. 9 A.M.		Humidity 9 A.M.			Rain		
	Dry	Wet	Dew Point	Vapour Pressure	Relative Humidity	Amount	Days	Heaviest fall
1900				In.	P.c.	In.	No.	In.
January	84·5	80·5	79·2	·995	88			
February	84·7	81·7	80·7	1·047	91			
March	85·0	80·8	79·5	1·003	87			
April	83·0	81·5	81·0	1·057	91			
May	83·6	80·8	79·9	1·019	92			
June	81·4	78·6	77·7	0·946	92			
July	79·5	76·1	74·8	·862	89			
August	78·9	76·2	75·3	·873	90			
September	79·1	77·1	76·4	·907	94			
October	82·3	80·3	79·3	1·000	91			
November	84·0	82·8	82·4	1·106	96			
December	84·5	82·4	81·7	1·082	94			
Year 1900	82·5	79·9	79·0	·991	91			
,, 1899	82·2	79·3	78·4	·970	88			
,, 1898	82·0	78·2	76·8	·922	84			
,, 1897	81·6	78·7	77·6	·951	88			
,, 1896	82·0	77·4	75·7	·886	81			
Mean, 1896–1900	82·1	78·7	77·5	·944	86			

Lamu. The rainfall for 1899 is partly estimated. No rainfall observations have been made since September of that year.

The rainfall was 41·29 in. in 1896; 32·28 in. in 1897; 12·39 in. in 1898; about 14 in. in 1899, and the mean (1896–1900) 28 in.

The heaviest fall (8·25 in.) occurred in April 1897.

Takaungu. Lat. 3° 41′ S., Long. 39 52 E. Observers: C. F. Braganza and G. H. L. Murray

Month	Rain		
	Amount	Days	Heaviest fall in 24 hours
1900	In.	No.	In.
January .	0·74	2	0·47
February .	1·83	5	0·43
March .	5·23	4	4·16
April .	3·65	7	2·45
May .	26·15	22	5·43
June .	2·05	9	0·68
July .	3·79	22	0·48
August .	1·12	13	0·27
September .	2·30	14	0·60
October .	6·40	13	2·72
November .	3·72	10	0·79
December .	1·11	6	0·40
1900	58·09	124	5·43
1899	33·15	116	2·08
1898	24·09	71	1·75
1897	54·40	104	5·13
1896	47·80	79	3·27
1895	35·71	68	3·30
Mean, 1896-1900	43·49	99	3·51

Kisimayu. Lat. 0 22′ S., Long. 43 33′ E. Observers: R. G. Farrant, Wallace Blake, and R. W. Humphrey.

Month	Average Atmospheric Pressure	Mean Temp.	Rain		
	9 A.M.	9 A.M.	Amount	Days	Heaviest fall in 24 hours
1900	In.		In.	No.	In.
January .	29·920	83·3	..	..	..
February .	·876	83·5	..	..	..
March .	·902	84·2	0·48	1	0·48
April .	30·338	85·6	·03	1	·03
May .	·135	84·1	3·67	6	1·83
June .	29·957	80·1	3·17	8	1·50
July .	·914	79·0	1·81	8	0·61
August .	·959	79·4	0 10	2	0·08
September	·997	80·0	·04	1	·04
October .	·936	80·1	·00	0	..
November .	·810	82·7	1·75	4	1·10
December .	·808	81·8	1·82	9	0·92
Year 1900	2·0·972	82·0	14·87	31	1·83
,, 1899	·925	81·1	12·40	37	4·12
,, 1898	29·885	80·8	10·91	30	3·44

The readings have been corrected for instrumental error.

The barometrical readings have been reduced to standard temperature of 32° and standard gravity in lat. 45°, but not to sea-level.

Nairobi. Lat. 1°2′ S., 36°57′ E., 5450 ft. Observers: W. D. Spiers, F. Gilkison, Louis S . . . [illegible].

Month	Rain		
	Amount	Days	Heaviest fall in 24 hours
1899	In.	No.	In.
October .	4·62	5	3·46
November .	2·30	10	0·75
December .	2·34	4	1·56
1900			
August .	0·00	0	..
September .	0·17	1	0·17
October .	0·47	8	·18
November .	6·48	15	·79
December .	5·26	13	1·79

Malindi. Lat. 3° 13′ S., Long. 40° 7′ E. Observer: James Weaver.

Month	Mean Temp. 9 A.M.		Humidity, 9 A.M.			Rain		
	Dry	Wet	Dew Point	Vapour Pressure	Relative Humidity	Amount	Days	Heaviest Fall
1900				In.	P. c.	In	No	In
January .	84·4	78·3	76·1	·899	82	0·87	6	0·35
February .	85·2	80·6	79·1	·992	86	·33	2	·18
March .	85·5	80·3	78·6	·975	81	·56	4	·30
April .	84 7	80 3	78·8	·987	86	1·96	6	·51
May .	82·4	79·2	78·1	·960	90	17·08	14	5 25
June .	79·7	76·5	75·4	·876	90	1·84	4	0 73
July .	78·4	74·4	72·8	·805	87	2·77	6	·66
August .	79·3	74·7	72 9	·808	86	1·72	5	·38
September .	79·7	75·2	73·9	·834	89	1·48	5	·67
October .	80 9	75·9	74 0	·838	85	2·30	7	·69
November .	80·3	77·4	76 3	·906	91	3 68	8	1 32
December .	81·5	77 7	76·4	·907	88	2 47	7	1 13
Year 1900	81 8	77·5	76 0	·898	87	47 05	74	5 25
,, 1899	81·4	75 9	73·8	·833	78	33 38	102	5 30
,, 1898	81·7	77 1	75·4	·882	81	14 41	53	1 65
,, 1897	..	..	..	..	..	58 00 [1]	91	4·85
,, 1896	81 1	78 0	76·9	·929	87	53 60	89	4·36
Mean, 1896-1900	81 5	77 1	75·5	·885	83	39·29	82	4 28

[1] Partly estimated.

Kitui. Lat. 1° 50′ S., Long. 38° E. Observer: S. L. Hinde.

Month	Temperature				Rain		
	Mean Max.	Mean Min	Extremes Max.	Extremes Min.	Amount	Days	Heaviest fall
1900					In.	No.	In.
July .	71·3	57·1	77	52	0·23	5	0·12
September	76·7	60 0	80	58	0 18	1	0 18
October .	74 6	62 3	78	60	13·81	7	4 40
November	80·5	62·0	..	60	12 58	12	2 80
December	75·6	63·3	78	61	14·55	14	3 20

Fort Smith, Kikuyu. Lat. 1° 14′ N., Long. 36 44′ E. Alt. 6400 feet. Observer: Francis G. Hall.

Month	Mean Temp. 9 A.M.		Humidity 9 A.M.			Rain		
	Wet	Dry	Dew Point	Vapour Pressure	Relative Density	Amount	Days	Heaviest fall in 24 hours
1899				In.	P.c.	In.	No.	In.
January .	59 9	65 5	63 2	·579	92	0 29	1	·29
February .	61·0	68 0	65 4	·624	92	0·81	2	·60
March .	60·1	66·5	63 8	·590	91	2·54	5	1 94
April .	62·0	65 0	63 8	·590	96	5 11	15	2·41
May .	60·0	62 8	61·8	·551	97	4 79	16	1 44
June .	55·3	57 6	56 5	·457	96	·67	2	·05
July .	54·0	58 6	56 2	·452	92	1·09	12	·25
August .	54·6	57 3	55 9	·466	98	·67	9	·17
September	56·8	60 4	54·8	429	82	·01	1	·01

During a thunder and hailstorm at 3 20 P.M. on May 18 the thermometer dropped 13 degrees in half an hour.

Machako's, Lat. 1° 31′ *S., Long.* 37° 18′ *E., 5400 feet. Observer: W. Maclellan Wilson.*

Month	Aneroid, 9 A.M.	Temperature: 9 A.M.	Mean Max.	Mean Min.	Extremes: Max.	Extremes: Min.	Humidity 9 A.M.: Dew Point	Vapour Pressure	Relative Humidity	Rain: Amount	Rain: Days	Rain: Heaviest fall in	Cloud (0-10) 9 A.M.	Mean Force of Wind (0-10)
1900	In.							In.	P.c.	In.	No.	In.		
January	24·74	66·1	75·7	56·4	79·2	54·7	58·7	·495	77	8·17	17	2·18	2·5	1·7
February	·74	67·9	75·1	57·9	78·7	52·5	58·3	·487	71	8·10	15	1·74	5·0	1·2
March	·74	66·6	75·1	59·0	78·5	54·6	60·1	·521	80	10·15	21	2·41	7·5	1·2
April	·74	65·8	74·0	59·2	78·2	56·1	58·7	·497	79	5·43	16	1·93	6·8	1·1
May	·85	63·9	73·0	56·9	75·8	48·0	57·9	·481	81	5·89	13	1·60	6·9	0·9
June	·86	61·3	71·0	54·8	73·6	43·5	55·2	·572	80	0·07	2	0·06	7·8	1·1
July	·86	59·6	68·1	52·7	72·6	47·9	53·6	·412	80	0·35	7	0·09	8·4	1·5
August	·81	60·6	70·7	53·1	76·8	42·9	53·7	·413	79	0·08	6	0·02	7·6	1·0
September	·80	62·5	74·3	54·5	78·3	48·0	53·8	·415	73	·00	0		7·3	1·2
October	·75	65·6	77·2	57·3	82·7	53·0	55·2	·457	71	3·40	8	1·53	4·9	1·4
November	·71	66·2	72·8	58·1	76·8	53·2	58·8	·496	78	8·04	21	1·04	6·5	1·6
December	·70	65·4	71·4	58·7	74·6	56·4	59·0	·501	81	8·04	28	0·95	6·6	1·6
Year 1900	24·775	64·3	73·0	56·7	82·7	42·9	56·9	·475	77·5	58·32	154	2·41	6·5	1·3

Machako's.—The force of wind is estimated according to a scale adopted by the observer thus: 0 (actually calm and included in the last column of our summary); 1, calm (velocity up to 0·5 mile); 2, light (velocity 6–15 m.); 3, moderate (velocity 16–25 m.); 4, fresh (velocity 26–30 m.); 5, strong (velocity 31–40 m.); 6, gale (velocity over 40 m.). The most frequent winds come from the SE., but the strongest blow from the N. and NNE. (force 2·7 and 2·0).

Machako's—continued.

Frequency, Direction, and Total Force (0–6) of Winds at 9 A.M.

Month, 9 A.M.	N. No.	N. Force	NNE. No.	NNE. Force	NE No.	NE Force	ENE. No.	ENE. Force	E. No.	E. Force	ESE. No.	ESE. Force	SE. No.	SE. Force	SSE. No.	SSE. Force	S. No.	S. Force	SSW. No.	SSW. Force	SW. No.	SW. Force	WSW. No.	WSW. Force	W. No.	W. Force	WNW. No.	WNW. Force	NW. No.	NW. Force	NNW. No.	NNW. Force	Calms No.
1900																																	
January	1	1	1	1	4	8	4	8	6	12	1	1	6	9	4	7	1	2	1	1	..	..	..	..	..	..	..	..	..	..	..	..	2
February	2	3	1	1	4	8	1	1	5	7	..	..	4	6	3	5	..	..	..	..	1	1	1	1	1	1	..	..	..	..	..	..	6
March	..	..	1	1	5	8	..	..	3	6	2	2	7	10	3	7	..	..	1	1	..	..	..	..	1	1	..	..	1	1	..	..	7
April	..	..	..	..	..	..	..	..	2	2	4	5	8	12	5	7	2	5	..	..	1	1	1	1	..	..	..	..	..	..	..	..	6
May	..	..	..	..	..	..	..	..	4	7	2	2	9	10	1	1	..	..	..	..	3	4	2	2	..	..	..	..	..	..	1	1	9
June	..	..	..	..	..	..	..	..	4	6	4	6	3	5	..	..	1	2	..	..	8	13	..	..	..	..	..	..	..	..	..	..	10
July	..	..	..	..	..	..	..	..	5	14	8	14	4	8	1	4	1	1	..	..	1	3	1	2	..	..	..	..	..	..	..	..	9
August	..	..	..	..	..	..	..	..	5	9	4	8	7	14	..	..	1	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	14
September	..	..	..	..	..	..	..	..	5	12	8	12	4	10	1	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
October	..	..	..	..	1	1	1	4	5	10	4	4	3	8	1	4	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8
November	1	5	2	8	2	6	3	5	1	3	2	3	5	11	4	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
December	2	7	8	19	2	4	2	3	3	6	1	2	2	3	1	2	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9
Year 1900	6	16	13	30	18	36	11	21	48	94	40	59	61	106	24	48	9	16	3	3	14	22	5	6	2	2	..	.	1	1	1	1	162

Kikuyu, about Lat. 1° 14′ *S., Long.* 36° 42′ *E., 6400 ft.*

Month	Mean Temperature: Max.	Mean Temperature: Min.	Rain: Amount	Rain: Days	Rain: Heaviest Fall
1900	°	°	In.	No.	In.
January	..	..	5·25	8	1·51
February	..	..	9·21	14	2·80
March	..	..	5·66	14	1·40
April	..	..	5·18	21	0·74
May	..	..	7·85	21	2·23
June	..	..	2·22	4	1·35
October	78·4	61·9	6·04	15	2·00
November	77·4	61·2	6·67	20	1·45
December	75·7	60·4	4·68	22	1·43

The observations up to June were made at the Station of the East African Scottish Mission (by Rev. T. Watson); the remainder at Fort Smith, 2½ miles distant from it, by the late Francis G. Hall.

Natete, near Mengo (Buganda). Lat. 0° 20′ *N., Long.* 32° 36′ *E., 4000 feet. Observer: A. M. Mackay, Church Missionary Society.*

Month	Rainfall. Amount in Inches: 1879	1881	1882	1883	1884	1885	1886	Rainfall. No. of Days: 1879	1881	1882	1883	1884	1885	1886	Mean Max. Tem.	Mean Min. Tem.
															F.	F.
Jan.	5·60	3·36	1·58	4·50	0·82	1·19	2·05	11	5	6	6	5	3	4	87·2	58·6
Feb.	3·85	4·84	4·96	2·60	3·30	5·04	3·83	12	9	12	5	5	6	5	86·0	59·6
Mar.	5·27	6·58	2·11	2·93	3·02	6·02	3·85	11	15	9	6	6	14	7	87·5	59·9
April	5·67	7·00	8·41	7·05	4·30	5·73	8·20	13	12	9	6	4	5	9	81·4	60·1
May	8·00	4·26	3·87	4·32	2·45	5·47	8·69	15	11	9	9	3	6	8	79·3	60·7
June	2·05	2·58	1·88	2·92	3·92	5·16	2·51	3	8	6	6	9	6	7	78·2	59·1
July	0·35	2·63	2·88	5·20	3·58	5·21	..	1	5	8	10	5	5	..	79·6	55·5
Aug.	1·14	3·50	3·10	4·75	1·40	3·46	..	9	8	4	9	6	5	..	82·1	57·4
Sep.	5·52	3·04	4·67	2·78	4·30	3·07	..	13	8	8	10	10	3	..	86·7	57·8
Oct.	3·48	3·54	7·00	2·27	2·24	5·52	..	11	11	12	8	9	5	..	88·6	61·8
Nov.	3·31	4·08	2·81	3·08	4·34	4·28	..	11	12	9	12	11	11	..	84·1	58·9
Dec.	1·52	2·34	1·04	0·80	0·29	2·04	..	6	5	5	5	2	7	..	84·2	58·7
Year	45·57	54·95	44·91	44·22	40·66	52·59	.	114	109	97	92	75	76	..	83·8	59·0

The above are taken from the journals of the late A. M. Mackay, brought to England by Dr. Junker. The temperatures are the means of observations made between January 1884 and June 1886. They have been corrected for supposed index errors, but the mean maxima appear to be still very much too high. In November 1885 the thermometer was removed to the north side of the house, and the mean maximum at once fell from 91·2 in October to 83·4 in November 1885. The mean for the months November to June, before the removal, was 84·5°, after the removal only 83·0°. According to observations made by Rev. E. Millar in 1893, the mean of all maxima was 81·8°, that of all minima 52·1° (see Third Report).

Victoria Nyanza Lake Levels and Rainfall, in Decades.
Observers: T. Pordage, F. A. Knowles, H. Galt, S. Spire, W. R. Walker, and others.

Decades		Ntebe, 1899 Lake Level	Fort Thruston, 1899 Lake Level	Ntebe (P. Alice), 1900 Lake Level	Rainfall Amt.	Rainfall Days	Rainfall Heaviest Fall	Fort Thruston (Lubwas) Lake Level, 1900	Kisumu, on Kavirondo or Ngowe Bay. Lake Level, 1900
		In.	In.	In.	In.		No.	In.	In.
January,	I.	+3·00	−0·76	−6·68	1·14	4	0·75	..	−5·30
,,	II.	2·62	−1·03	−6·38	1·12	4	0·62	..	−5·85
..	III.	2·67	−1·31	−6·12	0·60	..	..	..	−6·45
February.	I.	3·67	−2·81	−5·88	1·37	6	0·63	..	−7·80
..	II.	3·17	−2·56	−5·38	2·63	3	2·30	..	−8·20
..	III.	2·66	−1·85	−5·03	0·23	3	0·07	..	−4·67
March,	I.	3·04	−2·36	−5·33	0·02	1	0·02	..	−7·80
,,	II.	2·72	−2·98	−5·03	2·77	5	1·10	..	−8·20
,,	III.	2·47	−3·55	−4·53	3·31	8	1·39	..	−4·67
April,	I.	1·72	−3·73	−5·53	1·81	5	0·85	..	−5·10
..	II.	1·82	−3·68	−5·53	6·87	8	1·96	..	−5·50
..	III.	3·37	−2·48	−5·53	4·86	7	1·50	..	−3·90
May,	I.	3·64	−2·48	4·28	1·01	3	0·93	..	+0·75
,,	II.	4·54	+0·32	−5·03	0·47	4	0·27	..	−2·35
..	III.	4·22	+3·22	4·58	1·22	6	0·62	..	−2·94
June,	I.	4·89	+2·17	−4·28	4·09	4	2·82	−19·18	−2·50
..	II.	4·42	0·28	−3·63	1·69	6	0·80	−18·98	−1·50
..	III.	4·65	−1·13	−3·43	0·03	2	0·02	−18·53	−3·75
July.	I.	4·97	−3·08	−3·03	0·00	..	..	−18·83	−5·50
,,	II.	4·95	−2·73	−2·53	0·15	3	0·08	−18·88	−6·90
..	III.	3·61	−2·93	−2·15	0·28	1	0·28	−18·80	−7·76
August,	I.	2·17	−8·23	−2·78	1·00	4	0·35	−18·78	−6·97
,,	II.	+0·32	−12·48	−3·23	1·25	1	1·25	−18·73	−7·90
,,	III.	−2·30	−13·49	−4·12	0·65	1	0·65	−19·08	−12·57
September,	I.	−3·55	−16·38	−5·83	0·22	1	0·22	−20·43	−10·10
..	II.	−4·68	−17·08	−7·53	3·10	4	1·25	−21·13	−10·65
..	III	−6·58	−18·98	−10·23	0·11	4	0·04	−23·43	− 6·30
October,	I.	−6·33	−19·93	−13·33	0·15	4	0·05	−25·28	−15·05
,,	II.	−7·13	−21·78	−15·93	0·35	3	0·27	−26·78	−16·20
..	III.	−7·76	−22·43	−17·21	1·03	4	0·78	−29·21	−16·75
November,	I.	−8·30	..	−18·08	1·53	5	1·15	−30·18	−17·60
,,	II.	−8·88	..	−18·73	1·29	3	0·76	−30·13	−16·45
..	III.	−9·73	..	−19·53	3·17	8	1·36	−30·63	−16·90
December.	I.	−9·53	..	−18·98	4·24	4	1·61	−28·43	−15·97
..	II.	−8·93	..	−18·08	4·38	5	2·10	−27·68	−14·60
,,	III.	−6·48	..	−16·53	3·89	4	1·67	−23·03	−11·48

Ntebe, Rain, 1900

Month	Amount	Days	Heaviest Fall
	In.	No.	In.
Jan.	2·96	8	0·72
Feb.	4·23	12	2·50
Mar.	6·10	14	1·39
Apr.	13·54	20	1·96
May	2·70	13	0·93
June	5·81	12	2·82
July	0·43	4	0·28
Aug.	2·90	6	1·25
Sept.	3·43	9	1·51
Oct.	1·53	11	0·78
Nov.	5·99	16	1·36
Dec.	12·51	13	2·10
Year	61·43	138	2·82

There can be no doubt that the lake level is primarily influenced by the rainfall. At Ntebe the level rose in the course of 1898 (which was a year of abundant rains), but in the course of 1899 it fell slightly below the level of 1896, and in 1900 it fell a further 7·62 inches. As that year (1900) was one of fairly abundant rains along the Buganda shore (61 inches fell at Ntebe) we are bound to assume that it is not local rains which appreciably affect the level of the lake, but the precipitation throughout its vast drainage area. Thus an abundant rainfall along the Buganda shore would be neutralised by a deficiency in the rainfall in the south. Since the beginning of the present year (1901) the lake has risen rapidly, and by June 1 its level stood 24 inches above the mean level of 1896. The relations between local rainfall and lake level are illustrated by the following facts:—

At Ntebe, between March 20-24, 1900, 3·7 inches of rain fell, and in the course of April 13·54 inches, yet the level of the lake remained unaffected, the heavy local rains being balanced by the outflow and the loss by evaporation, or deficiency of rain elsewhere. Yet in the course of May the lake rose slowly, but steadily, although very little rain was registered locally. Again, between December 3-5, 4·24 inches of rain fell, while the lake only rose half an inch. More remarkable still, on September 12, 1·25 inches of rain fell, yet the lake level actually fell half an inch. The other stations afford similar instances.

The winds exercise a decided influence upon the level of the lake. There are regular land and lake breezes, and Mr. Macallister remarks that a strong SW. breeze will cause a rise in the level of the lake to an extent of from 1 to 3 inches. At Fort Thruston, on November 13, a severe storm caused the lake to rise 3 inches. The influence of the wind could be eliminated by making at least three observations daily, and which would be preferable, by establishing a self-registering gauge. Further fluctuations of the lake may be produced by differences of barometric pressure.

The difference between the highest and lowest level at Ntebe amounted to 19·0 inches in 1896, 16·5 inches in 1899, and 17·50 inches in 1900. The extreme range, as far as our observations extend, has been 43·5 inches; but if the level, in 1881, exceeded that of 1898 to the extent of 8 feet, as asserted by the French missionaries in Buganda, its amount cannot be less than 10 feet.

All observations made at Ntebe and Fort Thruston (Lubwa's) are referred to the mean lake level at those stations in 1896. On October 1898, Mr. C. W. Fowler, Superintendent of Marine, claims to have adjusted all gauges to Port Victoria (where observations ceased to be made at the end of July 1899). I fail to see how this can have been done unless the three stations were joined by a line of spirit levelling. On comparing the observations made between October 1898 and February 1899, as recorded, I find that, assuming the level at Port Victoria to be −0·60, the level at Ntebe exceeded that datum level to the extent of 1·08 inches, whilst that at Fort Thruston fell short of it to the extent of 1·89 inches. Such differences in the level may exist, though I fail to see how they can have been ascertained. From all observations recorded since October 1898, 36·53 inches have been deducted in order to reduce them approximately to the mean lake level of 1896. In the case of Kisumu, however, only 30·3 inches have been deducted.

Victoria Nyanza Lake Levels and Rainfall, in Decades—CONT.

In order to elucidate the interesting problems connected with the physical geography of the Victoria Nyanza, it would be necessary to instal rain-gauges throughout its drainage basin, and to establish at least four gauges for measuring the level of the lake, and to connect these gauges by lines of spirit level—a consummation most devoutly to be wished, though not likely to be realised for a considerable time to come. The observations should, as a matter of course, embrace all atmospheric phenomena, and more especially atmospheric pressure

Victoria Nyanza.—Lake Levels and Rainfall, Monthly Means.

Month	Ntebe (P. Alice)			Fort Thruston (Lubwa's)			Port Victoria (January to July 1899), Kisumu, on Kavirondo or Ngowe Bay (September 1899 to December 1900)					
	Mean Level	Extremes		Mean Level	Extremes		Mean Level	Extremes		Rain		
		Highest	Lowest		Highest	Lowest		Highest	Lowest	Amt.	Days	Highest Fall
1899	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	No.	In.
January	2·76	+ 3·97	+ 2·47	− 1·04	+ 0·97	− 1·53	+ 0·73	+ 2·47	− 1·03	...	3	..
February	3·20	+ 6·47	+ 1·47	− 2·42	− 0·53	− 3·53	− 0·63	+ 0·97	− 2·53	..	9	..
March	2·64	+ 3·97	+ 0·72	− 2·95	− 1·53	− 4·03	− 1·79	+ 0·97	− 3·53	1·05	8	0·29
April	2·50	+ 5·47	+ 0·97	− 3·30	+ 0·47	− 4·03	− 1·56	+ 1·47	− 5·03	3·38	18	0·98
May	4·14	+ 6·47	+ 2·97	+ 0·10	− 4·72	− 3·03	+ 2·21	+ 6·47	− 2·53	4·85	19	1·02
June	4·65	+ 5·97	+ 3·47	+ 0·78	− 3·47	− 2·53	+ 2·50	+ 5·47	− 0·53	2·55	10	0·88
July	3·58	+ 5·97	+ 1·47	− 2·92	− 1·53	− 5·53	− 3·96	− 0·47	− 8·53	0·10	1	0·1
August	0·02	+ 2·97	− 3·03	− 11·16	− 3·03	− 14·53	..	..	..	..	..	..
September	− 4·04	− 3·03	− 8·03	− 16·48	− 15·53	− 19·53	− 3·12	− 3·20	− 7·30	2·68	13	0·75
October	− 7·09	− 6·03	− 8·03	− 21·42	− 19·53	− 23·53	− 7·29	− 4·30	− 10·30	2·91	12	1·50
November	− 8·78	− 8·03	− 10·03	..	..	..	− 8·43	− 4·30	− 11·30	4·64	11	1·13
December	− 8·61	− 7·03	− 9·53	..	..	..	− 6·17	+ 2·20	− 11·80	5·04	14	1·83
Year	− 6·51	− 6·47	− 10·03									
1900												
January	− 6·38	− 6·03	− 7·03	− 21·5	..	..	− 5·85	− 1·30	− 8·30	5·18	17	1·84
February	− 5·46	− 5·03	− 6·03	− 21·5	..	..	− 5·94	− 2·30	− 10·30	6·45	14	2·54
March	− 4·95	− 4·53	− 5·53	− 21·5	..	..	− 7·14	− 1·70	− 12·30	4·64	11	1·30
April	− 5·53	− 5·53	− 5·53	20·5	..	..	− 4·88	− 1·80	− 7·30	5·04	14	1·82
May	− 4·95	− 4·53	− 5·53	− 19·5	..	..	− 1·62	− 2·70	− 5·30	1·88	10	1·05
June	− 3·78	− 3·03	− 4·53	− 18·90	− 18·03	− 25·53	− 2·58	− 0·70	− 6·30	2·86	11	0·91
July	− 2·66	− 2·03	− 3·03	− 18·84	− 18·53	− 19·03	− 6·75	− 3·30	− 12·30	1·56	10	1·06
August	− 2·67	− 2·53	− 4·53	− 18·87	− 18·53	− 19·03	− 8·91	− 6·30	− 12·30	2·70	10	0·85
September	− 7·86	− 5·03	− 11·53	− 21·66	− 19·53	− 24·53	− 8·98	− 4·30	− 12·30	3·66	12	1·04
October	− 15·53	− 12·53	− 17·53	− 26·16	− 24·53	− 30·03	− 16·03	− 10·30	− 19·30	2·89	5	2·35
November	− 18·57	− 17·53	− 19·53	− 30·41	− 29·39	− 32·03	− 16·98	− 12·30	− 24·30	6·27	10	1·96
December	− 17·82	− 15·53	− 19·53	− 26·27	− 21·53	− 30·53	− 12·78	− 5·80	− 18·30	6·23	10	1·35
Year	− 8·13	− 2·03	− 19·53	..	− 18·03	− 32·03	− 8·20	− 2·70	− 24·30	49·36	134	2·54

1899.—At *Ntebe* the lake attained its highest level on June 8. It stood lowest from November 25-28. The difference between the highest and lowest levels amounted to 16 inches.

1900.—At *Ntebe* the lake reached its highest level on July 21 and maintained it up to July 28. It stood at its lowest from November 21 to December 2. The difference between the highest and lowest levels amounted to 17·5 inches. During the whole of April the lake steadily maintained its level of 5·53 inches below the level of 1896.

At *Fort Thruston* the lake level was lowest on November 12, and highest on June 22, the difference amounting to 14 inches. At *Kisumu* it was lowest on November 3, highest on May 10, the range having been 27 inches, an amount accounted for by the position of the gauge in shallow water at the bottom of a bay and high winds.

1901.—At *Ntebe* the lake on June 1 stood 23·43 inches above the level of 1896; at *Kisumu* on May 7 it stood only 15·16 inches above the level, as assumed by us; and on June 28, 14·0 inches.

The bench mark cut on the Camp Tree at the head of Port Florence in 1898 by Commander B. Whitehouse, R.N., is 19 feet 11 inches above the zero on the Lake Gauge.

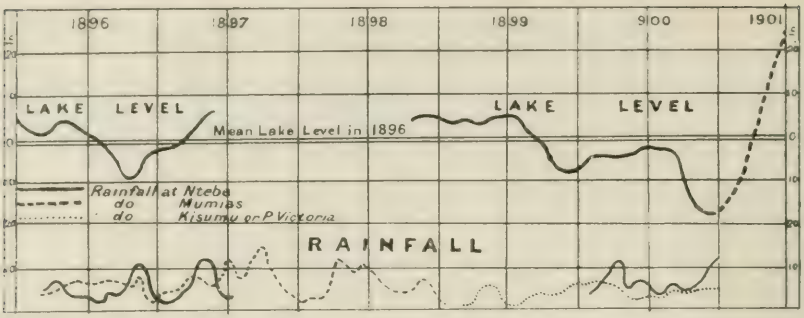

Diagram illustrating the Fluctuations in the Level of the Victoria Nyanza, at Ntebe, in 1896-1901, compared with the Rainfall.

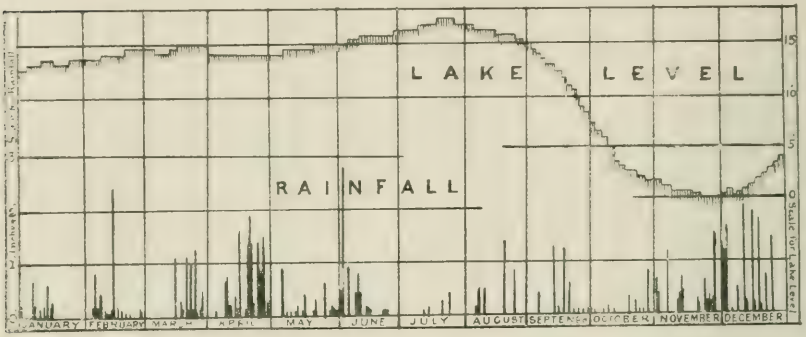

Diagram illustrating the Fluctuations in the Level of the Victoria Nyanza, at Ntebe, in 1900, compared with the Rainfall.

Annual Rainfall in British Africa, in Inches.

Year	British East Africa: Coast						British East Africa: Inland				Nyasaland		
	Kisimayu	Malindi	Lamu	Takaungu	Mombasa[1]	Chuyu (Wanga)	Kikuyu	Machako's	Fort Smith (Kikuyu)	Mumia's (Kavirondo)	Blantyre	Dunraven	Lauderdale
1890	..	..	29·0	..	34·7	..	..	..	..	..	..	..	..
1891	..	42·0	..	..	*46·9*	..	..	..	..	..	..	..	..
1892	..	*30·1*	..	32·1	*26·1*	..	..	..	..	..	..	89·8	..
1893	..	*50·8*	44·5	*40·7*	*64·2*	*66·3*	..	..	53·0	..	..	90·1	..
1894	13·7	28·9	21·1	38·0	38·0	42·0	26·7	42·0	48·1	..	..	95·4	104·4
1895	..	34·9	..	*35·7*	*52·9*	*48·5*	33·1	..	*65·0*	..	..	*106·0*	*151·7*
1896	19·5	53·6	47·5	47·8	65·2	56·6	21·7	25·9	29·7	58·8	52·0	95·4	108·1
1897	10·9	38·0	32·3	34·4	52·6	56·2	21·5	21·7	36·3	*93·5*	..	64·8	29·0
1898	10·9	14·4	12·4	22·0	25·0	27·3	..	24·3	36·2	69·10	60·0	*90·7*	*158·9*
1899	12·4	33·4	22·0	33·1	35·2	52·5	..	21·8	..	..	47·5	88·7	128·1
1900	12·9	37·0	..	*58·1*	*61·2*	59·8	..	*58·3*	..	50·0	29·6	*60·0*	*96·6*

[1] At Frere Town (opposite Mombasa) 41·9 in. fell in 1876; 91·1 in. in 1877; 51·3 in. in 1878; 45·6 in. in 1879; and 44·7 in. in 1880.

This summary shows that the annual rainfall varies exceedingly from year to year. At Mombasa, in the course of 11 years, it varied from 25 to 64 inches; at Machako's, during 6 years, from 22 to 58 inches. The years 1877, 1893, 1896, and 1897 and 1900 would appear to have been remarkable for an excessive rainfall along the coast of British East Africa; whilst in Nyasaland the years 1895 and 1898 were marked by heavy rains, whilst on the East coast these years were exceptionally dry. It seems thus perfectly clear that there is no relation between the rainfall and the frequency of sun-spots.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a meeting of Council held on 11th October, the following new members were elected, viz. :—

The Hon. The Master of Elibank, M.P. ; the Right Hon. Sir Hugh M. Nelson, K.C.M.G. (Queensland); Robert Fraser, J.P. (Brisbane); Alexander Young; Miss Helena K. Scott; Robert J. Duncan. The election of the three last-named members will have effect from the 1st November.

Captain Lemaire's African Pictures.

Captain Lemaire, whose paper on his Congo expedition appeared in last month's number of the *Magazine*, having kindly placed his large and valuable series of water-colour sketches at the disposal of the Council for exhibition in the Society's Rooms, the collection was on view from the 14th to the 19th October; it was visited by a large number of members of the Society, and of the public who were also invited to inspect it. The drawings, which are about 250 in number, and are the work of M. Léon Dardenne, an artist who accompanied Captain Lemaire throughout his journey, are shown just as he executed them on the ground. They afford a vivid illustration of tropical scenery and of the appearance and customs of the native inhabitants. The kindness of Captain Lemaire in permitting the exhibition of his collection has been highly appreciated by the Society.

Swedish Antarctic Expedition.

Intimation having been received of the expected arrival of the *Antarctic* at Falmouth on the 22nd October, the following telegram was despatched to Herr Otto Nordenskjöld, the leader of the expedition :—

"Cordial good wishes from the Royal Scottish Geographical Society for your success and safe return."

OBITUARY NOTICES

Baron Nordenskjöld.—By the death of Baron Nordenskjöld, the distinguished Swedish explorer, on August 12, geographic science has sustained a great loss.

Baron Adolf Erik Nordenskjöld was born at Helsingfors, in Finland, on November 18, 1832, and, although during the greater part of his life his home was in Sweden, he always retained a great interest in the affairs of his native land. His ancestors, originally Swedish, had settled

in Finland before the Grand Duchy passed into the hands of the House of Romanoff. In various members of the family we can trace the same scientific bent, Nils Gustav, the father of the deceased explorer, having been a distinguished mineralogist, and head of the Mining Office in Finland. His son's mind was thus early directed towards geological researches, accompanying as he did his father on his scientific tours.

Nordenskjöld entered the University of Helsingfors in 1849, and while there devoted especial attention to chemical and mineralogical work, and during the vacations he made excursions to interesting mineral localities in Finland. In 1853 he went with his father on a visit to the Urals, and was there able to extend his studies. He obtained appointments both at the university and mining office, but having had the misfortune to arouse the suspicion of the Russian authorities, he lost his appointments. He worked in Berlin for a time, and then returned to Finland, where he obtained the Alexander travelling stipend at Helsingfors University, his intention being to visit Siberia and Kamchatka. But at the Helsingfors University promotion festival of 1857, at which he was to take his Master's and his Doctor's degrees, an incident took place by which he again fell under the displeasure of the authorities, and was forced to leave the country. He thereafter settled at Stockholm, and to this change of domicile is due the immediate incitement of Polar voyages. Otto Torell, the great Swedish explorer, was then preparing for his first expedition to Spitsbergen, and Nordenskjöld offered to accompany him. Although Spitsbergen had been known for two centuries, no knowledge whatever was possessed of its geology and topography. During this voyage valuable observations were made, an important one being the discovery by Nordenskjöld of remains of tertiary plants, which with others, discovered by later expeditions, have led to important conclusions respecting the former climates of the country. In 1861 Nordenskjöld took part in Torell's second expedition, the results of which were greater than the former, the whole northern part of the island group being carefully examined. During this expedition the preliminary operations for the measurement of the arc of the meridian were carried out, both in the north and south of the group.

The next important expedition was to Greenland in 1870, and led to valuable scientific results. The geographical structure of the country was examined for the first time, and the great inland ice-sheet first trodden by a scientific observer. Dr. Berggren discovered a scanty vegetation covering the ice-sheet. The expedition of 1872 was not so successful as had been hoped. The two tenders were caught in the ice, and the crews were thus forced to spend the winter in Spitsbergen, thus causing an insufficiency of provisions. Nevertheless, valuable researches on the aurora and its spectrum, and on the Arctic flora of past epochs, with complete magnetic and meteorological observations, were made.

In 1875 Nordenskjöld commenced work in a new field, by a voyage to the mouth of the Yenesei, which river was ascended as far as Yeneseisk. The general public watched this expedition with interest, as it seemed to point to the possibility of a commercial sea-route from Europe to

Northern Asia. Further voyages were made the following year, and the circumnavigation of the northern shores of Europe and Asia was successfully completed. For the first time the expedition was also rich in scientific results. The record of the expedition is published under the title *The Voyage of the Vega.*

Nordenskjöld's last Arctic expedition was that to Greenland in 1893, undertaken with a view of testing the theory that a region free from ice and with rich vegetation might be found in the interior. The chief result of the voyage was to negative this idea, but valuable information as to the structure of the ice-sheet was also obtained.

During his later years Nordenskjöld devoted much time to the study of cartography, and his two most important works on the subject—*The Facsimile Atlas*, and the *Periplus*—are well known, and indispensable to students of cartography.

Sir Charles Bernard.—By the death, at Chamonix, of Sir Charles Bernard, late Chief Commissioner in Burma, the Society loses one of its Honorary Fellows.

Sir Charles Edward Bernard was born in 1837, and educated at Rugby, Addiscombe, and Haileybury. He was appointed to the Bengal Civil Service in 1858, and from that time till his retiral in 1888 held many important Government appointments. On his return to this country he became Secretary in the Revenue and Statistics Department of the India Office, an appointment he held until March last.

Sir Charles Bernard read a paper on Burma before the Society in November 1887.

GEOGRAPHICAL NOTES.

EUROPE.

Baltic and Black Seas Canal. The Odessa *Listok* states that a syndicate of Belgian capitalists is petitioning the Russian Government to approve a new project for joining the Baltic and Black Seas by means of a canal, at a total cost of 140,000,000 roubles. The term of years demanded by the Belgian projectors has not been disclosed, but it is generally supposed to be a long one. It is reported that the Russian Government consider the syndicate's demands excessive, and it is generally averred that the offer will not only be refused, but that any other offer, emanating from private capitalists, will not be entertained. It is felt that the canal, if ever constructed, will most probably be constructed by the Russian Government itself, as a national work. The depth of water provided for by the Belgian syndicate was 17 feet minimum.

The Siberian Railway.—It is expected that the junction of the Manchurian railway line with the rest of the Siberian railway system will be effected on October 14, and that traffic will be declared open throughout the entire railway system on November 8.

Trieste and its Commerce.—According to the Report of Mr. Consul H. L. Churchill on the Trade and Commerce of Trieste for 1900, the imports by sea far

exceed the exports. This fact is ascribed to the defective means of communication between Trieste and Central Europe, and is one of the principal causes of the want of increase of navigation in this port, for vessels coming with full or fair cargoes have often to leave in ballast, which naturally does not pay. In order to remedy this defect, the scheme of a second railway line from Trieste to the interior is strongly recommended by all interested in commerce connected with sea trade. It is held by competent authorities that the Hungarian port of Fiume is making far more headway than Trieste owing to several causes, the principal of which is that the port of Fiume is in direct and cheaper railway communication with Budapest by two lines to the south and the north, and is besides in direct communication with Vienna by the South of Austria railway system. Fiume has, moreover, the advantage of being in a position to export large quantities of timber from the inexhaustible forests of Hungary, and also flour from the large mills of Budapest. According to the latest statistics of the total trade of the seven principal Continental ports, Trieste's share 6 per cent., whilst Hamburg has 34, Marseilles 21, Genoa 17, Bremen 12, Venice 5·3, and Fiume 1·5 per cent. During 1900, 8465 vessels, with a tonnage of 2,158,624 tons, entered the port of Trieste. This shows a decrease of 421 vessels, with a tonnage of 23,122 tons, from 1899. Cleared, 8492 vessels, with a tonnage of 2,166,886 tons, showing a decrease of 373 vessels and 4931 tons. The principal flags were: Austro-Hungarian, Italian, British, and Greek. There were 159 British vessels, all steamers, of 228,434 tons, with 4373 crew, among the vessels that entered the port; which shows a decrease of twelve British vessels and 18,207 tons from 1899. Of these 159 vessels, 124 brought general cargoes, 20 coal, 11 rice, 1 fruit, 1 iron ore, and 2 were in ballast. Of the 157 British ships cleared during 1900, 124 took general cargoes, 2 war material, 1 rice, and 30 went in ballast. Harbour works for the enlargement of the port will begin in 1901. The Marine Board is continually engaged in the construction and repairing of moles, breakwaters, etc., down the whole of the Istrian and Dalmatian coasts. An electric railway, Trieste-Scorcola-Opcina, which will connect Trieste with the Karst plateau, is projected, as well as a railway trunk line, Gorizia-Aidussina, and operations will shortly commence. The Trieste-San Giorgio-Venice line has been put lately in conjunction with the Udine station. The construction of the Trieste-Parenzo railway has commenced, and will be finished in September 1902. The Ostend-Vienna-Trieste express, the itinerary of which has been modified lately, takes 37½ hours between the two ports, and is a great convenience to travellers by the Austrian Lloyd steamers. The population of Trieste at the beginning of the nineteenth century was 24,000; at the end of 1900 it amounted to 176,456. The death-rate was 29 per 1000 during 1900. The "Società per la lotta contro la Tubercolosi" has collected sufficient funds to erect a large sanatorium, which will be commenced at an early date. As the dearth of water in Trieste during the summer months has been the cause of much distress for many years, and to it are attributed many evils, the principal of which is that drains remain unflushed, and all noxious matter, instead of being carried away to the sea, remains just under the surface of most of the streets, with a consequent increase in the death-rate, works are now in active progress with the object of giving five times the existing quantity of water to the town by means of the Aurisinia waterworks, situated about six miles from the town. The horse tram has been almost totally abolished, and superseded by electric tramways with overhead wires. These electric tramways have been so well handled that though the streets of Trieste are in many cases narrow and tortuous, and pedestrians walk in the middle of the streets without any regard to their right or left, yet not a single serious accident has so far occurred. The

municipality contemplate extending the system largely in the suburbs, and cutting tunnels through some steep hills in the town in order to shorten journeys now taking much time and trouble.

Austrian steam navigation is at present flourishing. From 1894 to 1900 the progress of the mercantile marine has been very great. From 13 steamers, with 10,924 tons, it rose to 51 steamers, with 91,408 tons, the capitalists belonging not only to the Austrian littoral, but also to the interior of the Empire. The Austrian Lloyd Company commenced steam navigation in the year 1836. In 1872 the company had 66 steamers, with a total tonnage of only 34,429 tons, whilst at the end of 1900 the company had the same number of steamers with the greatly increased tonnage of 100,032 tons. The year was fairly prosperous for the company, but, like other companies, it suffered through the high price of coal. A new loan of 18,000,000 kr. £750,000) has been issued by this company, bearing interest at 4 per cent., and priority shares will be issued, not all at once, but at a future date, whenever new steamers will be built. The construction of eight or nine large steamers will shortly be commenced, in the company's dockyard of Trieste, for the Indo-China service.

ASIA.

Geographical Names in the Philippine Archipelago.—A special report has been published by the "United States Board on Geographic Names," giving the official spelling of about four thousand place-names of the Philippine Islands. The list has been prepared by Captain Todd of the U.S. Hydrographic Office: it is based chiefly on Spanish official charts; and has been revised by Father José Algue of Manila, who is regarded as the first authority on the subject.

British Interests in Persia.—The Indian Tea Association, on account of the depressed state of the industry, sent Mr. Foley, one of their number, to Persia, *viâ* the Nushki-Seistan route, to report upon the best methods of opening up an export trade thither. His report shows the difficulties to be overcome before trade can make any progress in that direction. The Persian Customs, although in charge of Belgian officials, are under Russian control. This control is administered in a manner inimical to Indian commercial interests. It is, therefore, necessary for our Government to have some definite policy, and to decide, as *The Times* urged on September 12, "What is indispensable and what is not, and how far they are prepared to go in the assertion of each part of their position," and further, if a friendly settlement is arranged between this country and Russia, as to the latter's claims in the Persian Gulf, a material part of the agreement between the two States would have to be, "A definition of their several relations to Persia."

Russian Railway Enterprise in Persia.—It is stated that the Russians are to proceed without further delay with the construction of a railway which will connect their Trans-Caspian line with the Persian province of Khurasan. The line will start from Askhabad, and enter Persian territory at Keltechinar, and run up the Deregez valley, and along the river-side until it strikes the existing road to Mashhad. It is expected the construction will be rapidly pushed forward.

Peking-Hankau Railway.—A surveying expedition in connexion with the Peking-Hankau railway left Peking on September 20. An accurate survey of the distances and character of the country southwards to the Yang-tse will be made. From there the expedition will move east towards the sea.

Dr. Schaffer's Expedition to Eastern Anatolia.—Dr. Franz Schaffer, the Vienna geologist, has now returned from his third expedition to Eastern Anatolia. This expedition was undertaken by authority of the *Gesellschaft zur Forderung der naturhistorischen Erforschung des Orients* in Vienna, to continue the investigations of the old Cilician province, and the work has been completed in a most satisfactory manner. Schaffer started from Mersina and travelled westwards across the High Plateau, and over the Dumbelek Dagh, and then traversed a new route in a west-south-westerly direction to Karaman. From here he went southwards to Ermenek and Cape Anamur, and again north-eastwards to Calycadnus. On this route, the mountainous district of Imbarus, that as yet belonged to the unknown part of the peninsula, was investigated. By way of Selefke the coast was reached, and a return was made to Mersina, from whence Shaffer travelled to Adana, and upwards to Ak Kopru, and then northwards to Bereketli Maden, and after an inspection of the Ala Dagh, the remainder of the journey was by way of Erjas Dagh—the highest mountain in the peninsula—to Kaisariya. From here Dr. Schaffer travelled homewards by way of Angora and Constantinople. By this expedition scientific, especially geological, research has gained much.

The Report of the Indian Famine Commission.—The above report, dated May 8, has now reached England, and it contains abundant evidence that the administration of famine relief improves with every famine. The Madras famine of 1901 resulted in hardly any mortality, and that of the Central Provinces in 1900 has been very slight. The people of Bombay were more heavily stricken, but they will know how to act in the future. The aggregate number of persons relieved by wages for work done is 625,794,000, and of persons gratuitously relieved is 509,559,000, making a total of 1,135,353,000.

Magnetic Survey of India.—Following their acceptance of the proposal of the British Association for an ethnographic survey of India, Lord Curzon's Government have adopted the suggestion of the Royal Society for the carrying out of a magnetic survey. Sunspots are believed to be closely connected with the perturbations of the magnetic needle, and, as Sir Norman Lockyer's inquiries are held by him to establish some association between sunspots and Indian droughts the survey, besides subserving the cause of science, may prove to be of some practical utility from the administrative standpoint. The existing magnetic observatories at Bombay and Calcutta being inadequate as base stations for the vast area the survey will cover, similar observatories are in course of construction at Dehra Dun, below the Himalayas, at Kodaikanal, in the Madras Presidency, and at Rangoon. The Dehra Dun observatory will be under the supervision of Colonel Gore, R.E., the Surveyor-General of the Indian Survey (whose headquarters are located there); but the other four will be in charge of Mr. John Eliot, the meteorological reporter to the Government. The Survey and Meteorological Departments will, in fact, be jointly responsible for the investigations. The field observations will be carried out by six or seven detachments of the Survey Department, and these will be controlled by Captain Fraser, R.E., who has recently been arranging in England for the purchase of the necessary instruments. Sindh and the Panjab will first be taken in hand; and, as the country is now intersected with railways in all directions, enabling field detachments to quickly cover the distances from one observing station to another, it is anticipated that five years will suffice to complete the field work of the preliminary magnetic survey.—*Times*, Sept. 11, 1901.

AFRICA.

French West Africa. M. Pierre Rambaud embarked on September 20 for Senegal, on a new geological exploration. He will examine the peninsula of Cape Verde, then if time permits will inspect a chalk bank at Kayes, or study the troglodytic dwellings at Konakry.

Railway Enterprise in the Congo Free State.—The decision of the Government of the Congo State to construct 1000 kilometres of railway lines in the upper Congo district, marks an important stage in the development of King Leopold's African Colony. The commercial and financial success of the line from Matadi to Leopoldville induced the authorities to consider the possibility of connecting by rail the districts of Welle and the Upper Nile with Tanganyika. After considering the question, it was decided two years ago to construct a line from Stanleyville, near the Stanley Falls—which are accessible at all seasons to steamers plying on the Upper Congo—with a terminus about 300 miles east of that station, on the tableland adjoining the Upper Ituri. From there the line was to branch off in a twofold direction, one portion going northward towards Lake Albert, and the other southward direct to Lake Tanganyika. The total length of these two branch lines was 950 kilometres, making in all 1400 kilometres, or nearly 900 English miles. It has been found necessary to modify the original plans, and the lines now decided on will start from Stanleyville and run direct to the extreme north of Lake Albert at Mahagi. A second line is projected, divided into three unequal sections, joining navigable points in the Lualaba, and thus connecting Stanleyville and the Upper Congo. One section will cover the rapids as far as Ponthierville (200 kilometres), whence communication will be carried on by water for 400 kilometres to the cataract below Nyangwe. The second section of the line will double the rapids above Nyangwe as far as the second navigable reach, whence a third section will run to Lake Tanganyika. Thus Lakes Albert and Tanganyika will be brought into direct communication with the Congo river, through a country of very rich soil and capable of rapid development. It was decided from the first that the new lines should permanently remain the property of the Free State.

Trade of Dahomey. Mr. Consul Arthur's report on the trade of Dahomey, just issued by the War Office, shows a satisfactory growth in the prosperity of the region. The imports have increased to £590,000 last year, and the exports to £510,235. The total trade has increased over 50 per cent. in the last three years. The trade is wholly divided between the United Kingdom, Germany, and France. British imports last year amounted to 41 per cent. of the whole, and are increasing. The exports are palm kernels and palm oil, Lagos receiving the greater part of the trade, transmitting the oil to Great Britain, and the kernels to Germany.

Anglo-Abyssinian Frontiers. Major Austen's expedition, now on its way home from Lake Baringo, has, in addition to the boundary work performed, completed another piece of frontier delimitation under Major C. W. Gwynn, R.E. That officer, after assisting Colonel Harrington at Addis Abbaba for three months in the details of the frontier settlement with the Emperor Menilek, set out in March for the purpose of surveying a further section of the boundary from the Blue Nile northwards. Practically all the Anglo-Abyssinian frontier has now been mapped in detail, and a definite line adopted for administration purposes.

Geological Discoveries in Egypt.—As the result of an expedition organised by Captain Lyons, Director-General of the Egyptian Geological Survey, discoveries

of Eocene mammals of considerable scientific importance have been made in the Fayûm. At the request of Captain Lyons, leave was granted to Dr. C. W. Andrews, of the Department of Geology, by the authorities of the British Museum, to go on this expedition in company with Mr. Beadnell, a member of the Egyptian Geological Survey staff, who has surveyed and mapped the region of the Fayûm. In examining the escarpments of Upper Eocene and Oligocene age southward, the two explorers discovered a very rich deposit from which they obtained an extensive collection of fossil remains. The specimens were found along about 30 miles of the escarpment at various levels; and, although in many cases the bones were much cracked and broken by the extremes of temperatures to which they had been subjected, they arrived in very fair condition at the Natural History Museum at South Kensington, where the collection has been sent in order to be worked out and described by Dr. Andrews. The more notable of the finds are—a large dinotherium-like animal, generically distinct from any known form; a mastodon-like animal, also new; the vertebral column of a gigantic lizard; remains of tortoises; and numerous bones of eotherium, an aquatic vegetable-feeding mammal belonging to the Order Sirenia and very distinct from the Cetacea. All the specimens were obtained from beds of Upper Eocene, or in some cases from Lower Oligocene age, whilst the earliest Proboscidean previously known is from the Lower Miocene. The greatest scientific interest centres round the two first-mentioned specimens, which Dr. Andrews believes are probably remains of ancestral forms of the dinotherium, the mastodon, and the elephant of the present day. These three forms, representing the Proboscidea (elephants), extend from the Miocene epoch to the present time, and are of nearly world-wide distribution, save on the island continents of Australia and New Guinea; and it is worthy of note that though they form a well-marked sub-order, distinct from other types of hoofed animals, their direct ancestry has up to the time of Dr. Andrews' discovery and determination of his Fayûm specimens been unknown to palæontologists.

In his preliminary description of the specimens, which appears in the *Geological Magazine*, Dr. Andrews draws attention to the importance of further investigation of the tertiary deposits of the Libyan Desert as likely to throw great light on many obscure questions of geographical distribution by the probable discovery of many species, for it is certain that in the present collection there is represented only a very small fraction of the species which existed. Another point of importance is that the fauna described by Dr. Andrews differs entirely from that found in deposits of the same age in Europe, and points to the existence of a large land area to the south which had long been isolated. One long-standing problem—the place of origin of the Proboscidea—may perhaps be regarded as solved by these discoveries. Probably it was not till a later period when the dinotherium, the mastodon, and the elephant had been evolved and when Africa and the land to the north were joined by land communication, that these animals found their way over an area extending from England, France, Germany, Switzerland, Italy, Greece, Samos, Persia, Armenia, India, and Ava to North and South America, in all of which localities remains of mastodon and elephants occur.

AMERICA.

River Profiles in the United States are the subject of a valuable publication of the U.S. Geological Survey. Mr. Gannett, who has drawn up this report, has tabulated the available information with regard to one hundred and fifty of the chief rivers, indicating their length, drainage-area, gradient, and the position and amount of water-power. The rivers selected are those which are the largest in

size, and bear most directly upon the varied interests of the country : *e.g.* the Connecticut, Hudson, Susquehanna, Ohio, Potomac, Mississippi, Platte, Missouri, Colorado, Sacramento, Columbia, etc. The figures for the tables, showing height above sea-level and fall per mile, were collected from various sources ; some were obtained from the report of the Chief Engineer of the U.S. Army ; some from the railway companies whose lines cross the streams ; and others from the atlas sheets of the U.S. Geological Survey. In the case of such rivers as the Connecticut, Susquehanna, Mississippi, and Colorado, where the surrounding country is of peculiar physiographic interest, very excellent and vivid descriptions of the leading physical characteristics are given which add to its interest and render this publication valuable from the educational point of view. *National Geographic Magazine*, August 1901.

The cultivation of Rubber in the West Indies has often been advocated in recent years, and several experimental plantations have been made with a view to determining what trees are most fitted to the climate and soil, the best methods of cultivation, and the probable value of the proposed industry. In this connection the studies of Mr. J. H. Hart, superintendent of the Royal Botanic Gardens at Trinidad, reported in the *Imperial Institute Journal* August 1901, are of considerable interest. All the most important rubber-yielding trees have been supplied to the West Indian Botanic Gardens by the authorities at Kew, and those under observation in Trinidad include the Central American tree *Castilloa elastica*, the Para tree *Hevea brasiliensis*, the Ceara tree *Manihot Glaziovii*, the East Indian or Assam tree *Ficus elastica*, several species of African rubber vines (*Landolphias*), and the West African of Lagos silk rubber tree (*Funtumia elastica*, previously known as *Kickxia africana*). These plants are of widely different habits, but by proper choice of situation they could all be grown in different parts of the island. The yield of rubber from *Ficus elastica* is, however, small compared with that from the other trees, so that its cultivation in the West Indies is unlikely, while the climbing habit of the *Landolphias* renders them unsuitable for the purpose. The other four trees were much more likely to give satisfactory results, and have consequently received most attention.

The Central American tree grows very freely in Trinidad, being most suitable for plains at low elevations. The largest tree in the gardens is over 75 feet high, with a girth of 6 feet at 3 feet from the ground ; while in a small field at the experiment station, planted in July 1898, the five best trees now average nearly 18 feet in height and 12 inches in girth. The latter have received no special cultivation, and are growing on part of an abandoned sugar estate, where the land is of poor quality, but fairly well drained and shaded. In another part of the station a set of trees were planted out under shade, but although started before the above, the present height is not more than 8 feet. Many thousands of seedlings have been supplied to planters from the nurseries, and although planted out under very varying conditions, they have all done well, there being at present eight private plantations of considerable extent in the island.

Experiments have been made to determine the yield and quality of the rubber, but the tapping was very carefully carried out, so as not to affect the seed-bearing power of the trees. Under these conditions one of the largest trees gave 2·14 lb. of latex, from which ·69 lb., or 32 per cent., of clean rubber, worth 3s. per lb., was obtained. An attempt to tap the younger trees led to an interesting result, for the latex so obtained was found to contain little or no rubber, but yielded 25 per cent. of a putty-like mass, devoid of elasticity, which became hard and brittle. This product would be of no value ; and it appears that eight years is

about the lowest age at which the tree will yield good rubber, a point of considerable interest to planters. The rubber from *Castilloa elastica*, however well prepared, always becomes soft and sticky if kept in a hot climate, so that it should be exported as soon as possible after preparation.

The Para tree was at one time thought to thrive only in swampy districts, but in Ceylon it has been found to do best on fairly flat land with good alluvial soil at about sea-level. In Trinidad it grows very freely in the gardens, where the largest tree is about 50 feet in height and 5 feet in girth, and is also met with on dry, gravelly soil. Seedlings planted out in July 1898 are now over 18 feet in height, with an average girth of 6½ inches, so that it is of slower growth than the Central American tree. Rubber of excellent quality is freely yielded by the large trees, and keeps better in the hot climate than any other kind. It is easily obtained, as all that is needed is to slightly wound the tree, and collect the spontaneously coagulated rubber some twenty-four hours afterwards. In places where the roots of the tree have become exposed it has been found possible to extract large quantities of rubber from them. At the present time a considerable area in the valley of one of the largest rivers in Trinidad is being planted with *Hevea*, and as the situation closely resembles the natural habitat of the tree very good results are anticipated. A variety of *Hevea brasiliensis*, which is said to thrive in dry localities, since it was found on the mountain sides of the upper reaches of the Orinoco, has been introduced at the experiment station, and has been found to yield a seed not more than half the ordinary size. In addition there are several trees of *Hevea confusa* growing in the gardens, but the rubber yielded at present is valueless, being yellow and sticky, though it is possible that the quality may improve with the age of the tree.

The Ceara tree thrives well in some districts of Trinidad, but is only suitable for dry hill-sides or mountain lands, and will not succeed on flat alluvial soils. Its rate of growth seems to depend largely on situation, as trees at a private plantation on warm and sheltered hill-side land have grown twice as fast as those at the experimental station. The yield of rubber appears to be very variable; from some of the trees very little could be obtained, while others, though only two years old, gave small quantities of fairly good rubber. The tree has proved unsatisfactory in Ceylon and elsewhere, as the yield of rubber has been so small that it has not covered the cost of collection, and, on that account, is not likely to be extensively tried in the West Indies.

The West African rubber tree, although a comparatively recent introduction into Trinidad, appears to be a most promising plant, growing very freely at the experimental station, where three-year-old trees now average 13½ feet in height and 7 inches in girth. They look as if they would speedily become large trees, and even at present yield latex freely, the rubber from which is of excellent quality and keeps well. The tree grows well even when fully exposed to the sun, though it does better under shade, and appears likely to prove very valuable to cultivators.

That rubber trees will thrive in Trinidad is therefore well established, and, under fairly similar conditions of climate and soil, there is no doubt that they would also flourish in the other islands as well, especially as confirmatory results have been obtained in Jamaica, Dominica, and Tobago. The particular tree will have to be selected in view of local conditions, but *Castilloa elastica*, *Hevea brasiliensis*, and *Funtumia elastica* are the three most suitable for general cultivation. It is hoped that it will soon be possible to conduct a series of experiments to determine the average yield and quality of the rubber from the different trees under the conditions of cultivation, so as to furnish trustworthy information on

the point to intending planters. The cost of planting can only be approximately estimated, but it is certain that it would not be as much as for cacao, which ranges from £12 to £15 per acre, and in most cases half these amounts would probably suffice. In cultivating rubber-trees a very important point is to obtain clean and straight stems, which greatly facilitate the tapping process, and the best method of attaining this is to plant closely at first, afterwards thinning out the weaker trees. If planted too far apart to commence with the trees grow very bushy, and the extraction of the rubber is rendered much more difficult. The chief care to be taken in the actual planting is to see that the trees are not put too deeply in the soil. It was suggested by Dr. Morris several years ago that rubber-trees, particularly *Castilloa elastica*, might be used as shade trees for cacao, thereby combining the two industries to the great advantage of the planter, and this has been tried with great success in British Honduras, as well as in Trinidad and Tobago.

AUSTRALIA.

The proposed Trans-Australian Railway is intended to connect Port Augusta, the western terminus of the South Australian system, with Kalgoorlie, in the West Australian goldfields. The line will run along the coast of the Great Australian bight. A new impetus has been given to the scheme by the recent federation of the States; and it is anticipated that the proposed railway, the cost of which is estimated at about two and a half millions sterling, will shortly be adopted by the Australian Government. The railway systems of the several States are at present built upon different gauges: thus, South Australia, West Australia, and Queensland use a gauge of 3 ft. 6 in.; the Victorian railways have a gauge of 5 ft. 3 in.; while New South Wales employs the standard gauge of 4 ft. 8½ in. In an account of the Australian railway system in the *National Geographic Magazine* August 1901, it is pointed out that in June of last year there were 12,589 miles of railroad in Australia, almost all of which were owned and worked by Government. These lines merely skirt the eastern, western, and southern shores of the island continent; and their entire length is small in proportion to its 2,946,358 square miles of territory. Nevertheless, this railway development appears remarkable when one considers that the population is hardly more than four and a half millions. Four of the provinces—New South Wales, Victoria, South Australia, and Queensland—are connected by rail with one another: that is, one can make a circuitous tour, skirting the shore, from Longreach in Queensland to Oodnadarta in South Australia; but on arriving at the last-named settlement one is still about one thousand miles distant from the nearest railway station in West Australia. That State is therefore entirely isolated from the rest of the Commonwealth.

A discovery of subterranean lakes in the Eucla district north of the Great Australian Bight is reported. The lakes were found by natives employed by Mr. G. B. Scott, and are sixteen miles west of those discovered by Mr. Juncker. They contain an apparently unlimited supply of good drinking water at a depth of 30 feet from the surface, and in country providing good indigenous bush feed for cattle. This fresh discovery emphasises the possibility of revolutionary developments in Central Australia which may yet make feasible an amount of inland settlement, of which we have not previously conceived in that drought-stricken area. This discovery also casts some light upon the problem of what becomes of the Central Australian waters not lost by evaporation, and of the rivers which disappear so provokingly. The solution of this problem would probably go far to settle the problem of utilising the country whose only lack is water. J. B.

Lieutenant Peary's American Polar Expedition has sent reports by the ss. *Erik*, which succeeded in communicating with the *Windward* during the past summer. Lieutenant Peary, who proposes to winter in the north, and to renew his attempts towards the Pole in spring, has reached the latitude 83° 50′, which is the highest yet achieved in the western hemisphere, and has mapped the northern coast of Greenland.

GENERAL.

The Swedish Antarctic Expedition, under Dr. Otto Nordenskjold, is on its way south, in the *Antarctic*, a vessel well known in connection with researches in Arctic regions. With the leader of the expedition are associated Mr. Skottsberg, botanist; Dr. Ekelof, surgeon and bacteriologist; Dr. Ohlin and Mr. K. Anderson, zoologists; Dr. G. Bodman, who is responsible for the magnetic and hydrographic work; and Captain C. A. Larsen, navigating officer. It is intended to proceed to Buenos Aires, and thence to Staaten Island, the South Shetlands, and Graham Land, where it is hoped that Dr. Nordenskjold will winter with several of the members of his staff.

Ordnance Survey of Scotland.—The following publications were issued from 1st to 31st July 1901:—Parish Maps (Scale 1:2500, Revised, with Houses ruled, and with areas, Price 3s. each). *Aberdeenshire.*—Sheets XIV. 8, 12, 16; XV. 5, 9; XIX. 8, 11; XX. 5; XXII. 4; LXV. 16. *Perthshire.*—Sheets LXIII. 14; LXIV. 10, 13, 14; LXXIII. 16; LXXIV. 1, 2, 6, 7, 15; LXXV. 1, 5; LXXXVI. 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XCVIII. 12; XCIX. 1. *Zetland.*—Sheets XLII. 16; XLIII. 15, 16; XLVI. 6, 7, 8, 10, 11, 12, 16; XLVII. 3, 5, 6, 9, 12, 16; XLVIII. 2, 3, 6, 7, 9, 10, 14, 16; LI. 6, 7, 10; LII. 2, 3, 4, 7, 11, 14, 15; LIII. 5, 6, 9, 10, 11, 13, 14, 15; LVI. 3, 4, 7, 8, 9, 12, 13; LVII. 2, 6. NOTE.—There is no coloured edition of these Maps. The unrevised impressions of these sheets are withdrawn from sale.

Four-Mile Maps of Scotland by Counties, with roads and water printed in colours—Orkney, Price 9d. With water printed in colour—Zetland, Price 9d.

Six-inch Maps (Quarter Sheets—Revised). *Perthshire.*—7 NW.; 78 NW.; 89 NW. (Price 1s. each). With contours: *Aberdeenshire.*—44 SW.; 47 NW.; 52 NE.; 71 NE.; 73 SW.; 85 SW. (Price 1s. each). *Clackmannanshire.*—127 SE.; 140 NW. (Price 1s. each). *Perthshire.*—52 SW.; 73 NW.; 84 NE., 84 SW., 84 SE.; 95 SE.; 96 NE., 96 SE.; 108 SE.; 117 NE.; 126 NW.; 127 SE. (Price 1s. each).

The Zincographs of the undernamed Ordnance Survey Plans having, in many cases, been sold out, another edition has been printed, and is now ready for sale. All plans hitherto published in Sections are filled in complete to their margins or to the County Boundary. No revision of the original plans having taken place, these impressions are similar to those already issued to the public, except as stated above, or as notified in the following Remarks. *Caithness-shire.*—III. 1: *Elginshire*, XII. 14; *Kincardineshire*, VII. 3; all at the Scale of 1:2500, with areas added, but the old edition will be sold out. General remarks, July 1901. *Caithness-shire.*—Canisbay, III. 1; *Elginshire.*—Elgin and Dallas, XII. 14: *Kincardineshire.*—Maryculter, VII. 3: all at a Scale of 1:2500, with areas added; coloured price now altered to 3s.; uncoloured are 3s. each with areas, and 2s. 6d. each without areas.

Catalogue of the Ordnance Survey Publications of Scotland, revised and corrected to the 1st January 1901. This is the last edition issued.

Ordnance Survey of Scotland.—The following publications were issued from 1st to 31st August 1901 :—Parish Maps (Scale 1 : 2500, Revised, with Houses ruled, and with areas. Price 3s. each). *Aberdeenshire.*—Sheets XXVI. 9; XXVIII. 2; LXVI. 13, 14, 15; LXXIV. 4, 8, 12, 16; LXXV. 4, 5, 8, 9, 13; LXXXV. 4, 8. *Forfarshire.*—Sheets XXX. 6, 9, 11, 15; XXXI. 1, 5, 9, 13; XXXVII. 9; XLIII. 14; XLVIII. 3, 4; XLIX. 1, 3, 5, 6, 7, 11. *Inverness-shire.*—Sheets LXXXVII. 8, 11, 12, 15, 16; LXXXVIII. 5; CII. 1, 2, 3. *Perthshire.*—Sheets XLIII. 9, 10, 15, 16; LIII. 4, 7, 8, 16; LXIV. 8, 11; LXXIV. 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 16; LXXXVI. 1, 3, 4; XCVIII. 5, 9. *Zetland.*—Sheets XLVIII. 5; LII. 6; LVI. 2, 6, 11, 15; LVII. 1, 3; LIX. 4, 5, 8, 12, 15, 16; LXII. 7, 8, 10; LXV. 6.

Note.—There is no coloured edition of these Maps. The unrevised impressions of these Sheets are withdrawn from sale.

Six-inch Maps Quarter Sheets—Revised. *Aberdeenshire.*—102 NW., 102 NE. (Price 1s. each). *Perthshire.*—(3 NW. and 3 SW.), 3 SE.; 4 NE., 4 SW., 4 SE.; 9 NE., 9 SW., 9 SE.; 10 NW.; 17 NW., 17 NE. (Price 1s. each). With Contours :—*Aberdeenshire.*—22 SE.; 26 SE.; 29 SW.; 30 NW.; 31 NE., 31 SE.; 34 SE.; 35 NW.; 37 SE.; 43 NE.; 44 NE., 44 SE.; 45 NW., 45 SW., 45 SE.; 46 SW.; 47 NE.; 48 NE.; 53 NE.; 54 NE., 54 SE.; 55 SW., 55 SE.; 56 NW., 56 NE., 56 SW.; 57 SW.; 62 SE.; 63 NW., 63 SW.; 64 NW., 64 NE., 64 SW., 64 SE.; 65 NE.; 66 NW., 72 NW., 72 NE., 72 SW., 72 SE.; 74 NW.; 84 SE. (Price 1s. each). *Clackmannanshire.*—134 NE., 134 SW. (Price 1s. each). *Perthshire.*—62 SW.; 63 NE.; 64 NW.; 73 SW.; 85 NW., 85 SW., 85 SE.; 95 NE.; 96 NW., 96 SW.; 97 SW.; 108 NE.; 109 NW.; 117 NW.; 118 NW.; 127 NE.; 128 SW.; 134 NE.; 135 NW. (Price 1s. each).

The Zincographs of the under-named Ordnance Survey Plans having, in many cases, been sold out, another edition has been printed, and is now ready for sale. All plans hitherto published in Sections are filled in complete to their margins or to the County Boundary. No revision of the original plans having taken place, these impressions are similar to those already issued to the public, except as stated above, or as notified in the following Remarks.

Banffshire.—I. 12; now made a full sheet. *Caithness-shire.*—XXXIX. 13. *Cromartyshire.*—LXXVII. 16; with areas added; but the old edition will be sold out. *Kincardineshire.*—III. 16; VII. 12; now made a full sheet and areas added. *Ross-shire.*—LXXVII. 16; with areas added: but the old edition will be sold out, all at the Scale of 1 : 2500. General remarks, August 1901. *Caithness-shire.*—Latheron, XXXIX. 13. *Cromartyshire.*—Resolis, LXXVII. 16. *Kincardineshire.*—Maryculter, III. 16; with areas added; coloured price now altered to 3s. Fetteresso and Banchory Devenick, VII. 12; coloured price now altered to 1s. *Ross-shire.*—Avoch, LXXVII. 16; with areas added; coloured price now altered to 3s. All at the Scale of 1 : 2500; uncoloured are 3s. each with areas, and 2s. 6d. each without areas.

Catalogue of the Ordnance Survey Publications of Scotland, revised and corrected to the 1st January 1901. This is the last edition issued.

Ordnance Survey of Scotland.—The following publications were issued from 1st to 30th September 1901 :—Parish Maps (Scale 1 : 2500, Revised, with Houses ruled, and with areas. Price 3s. each). *Aberdeenshire.*—Sheets XX. 2; XXV. 7, 8, 10, 12, 13, 14, 15, 16; XXVI. 5, 13; XXXIII. 2, 4, 5, 6; XXXIII*a*. 8; XXXIV. 1; XLII. 9, 10, 11, 12, 14, 16; L. 15; LI. 2, 4; LX. 3, 6, 7, 10, 11, 14, 15; LXVI. 16; LXVIII. 6, 7, 8; LXIX. 1, 3; LXXV. 1, 2, 3, 6; LXXXVI. 1, 2, 3, 5. *Banffshire.*—Sheets XXXVIII. 9, 10, 14. *Forfarshire.*—Sheets XXIII. 11, 14; XXIV. 6, 7, 11;

XXX. 4, 8, 10, 12, 16; XLIII. 13; XLVIII. 8, 12; XLIX. 9, 10, 13; LIII. 5. *Inverness-shire.*—Sheet LXXXVII. 14. *Orkney.*—Sheet LXXIII (1 and 5). *Perthshire.*—Sheets LIII. 12; LXIV. 7. *Zetland.*—Sheets LIX. 1; LXII. 9, 11, 12, 13, 14, 15; LXV. 1, 2, 3, 5, 9, 10, 13, 14; LXVII. 1, 2, 5, 6, 10, 14.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Six-inch Maps (Quarter Sheets—Revised). *Perthshire.*—7 SE.; 51 SE. (Price 1s. each). With contours: *Aberdeenshire.*—20 SW., 20 SE.; 21 SE.; 22 SW.; 23 NE., 23 SW., 23 SE.; 27 SW., 27 SE.; 28 NE., 28 SW., 28 SE.; 29 NW., 29 NE., 29 SE.; 30 NE., 30 SW., 30 SE.; 31 SW.; 32 NE., 32 SW.; 34 NE.; 35 SW., 35 SE.; 36 NW., 36 NE., 36 SW., 36 SE.; 37 NE., 37 SW.; 38 NW., 38 NE., 38 SW.; 39 NW., 39 NE., 39 SW., 39 SE. (40 NW. and SW.; 44 NW.; 46 NW., 46 SE.; 47 SW., 47 SE.; 48 NW.; 52 SE.; 53 NW., 53 SW., 53 SE.; 54 SW.; 55 NW., 55 NE.; 56 SE.; 57 NW.; 62 NE.; 63 NE., 63 SE; 65 NW.; 66 NE.; 71 SE.; 82 SE.; 93 SE. *Clackmannanshire.*—133 NW. *Perthshire.*—62 SE.; 85 NE.; 97 NW., 97 NE., 97 SE.; 109 SE.; 111 SW.; 118 SE.; 133 NW. (Price 1s. each).

The Zincographs of the under-named Ordnance Survey Plans having, in many cases, been sold out, another edition has been printed, and is now ready for sale. All plans hitherto published in sections are filled in complete to their margins, or to the county boundary. No revision of the original plans having taken place, these impressions are similar to those already issued to the public, except as stated above, or as notified in the following remarks. *Forfarshire.*—XLIII. 4; now made a full sheet. *Inverness-shire.*—XIII. 3; with areas added, but the old edition will be sold out. *Ross-shire* and *Cromartyshire.*—LXXVII. 15; now made a full sheet and areas added. All at the Scale of 1 : 2500. General remarks, September 1901. *Forfarshire.*—Glamis, XLIII. 4; coloured price now altered to 4s.; Eassie and Nevay, XLIII. 4; formerly printed on XXXVII. 16, now made a full sheet with Glamis parish; price 4s. coloured. Total number of plans in this parish is now altered to 12. *Inverness-shire.*—Croy and Dalcross, XIII. 3. *Ross-shire* and *Cromartyshire.*—Resolis, LXXVII. 15. *Ross-shire.* Avoch, Urquhart, and Logie Wester, LXXVII. 15; with areas added; coloured price now altered to 3s. All at the Scale of 1 : 2500.

Catalogue of the Ordnance Survey Publications in Scotland, revised and corrected to the 1st January 1901. This is the last edition issued.

NEW BOOKS.

Australasia, The Commonwealth, and New Zealand. By ARTHUR W. JOSE. London: J. M. Dent and Co., 1901.

This latest publication of the "Temple Primers" Series is like many of the others a model of condensation. Mr. Jose first gives us a brief but clear description of the physical features of Australasia and New Zealand, and then a sketch of the history of the colonies, commencing with what is known or conjectured of Portuguese, Spanish, and Dutch discovery, and ending with the federation of the Commonwealth last year. There is also a useful chapter on the indigenous races and one on Australia of to-day. To those who do not care to face more detailed and controversial works on the subject, such as those of Ruxden, Parker, Wallace, etc., this useful little volume may be readily commended.

The Bolivian Andes. By Sir Martin Conway. London and New York: Harper and Brothers, 1901. *Price* 12*s.* 6*d.*

The volume now before us is one of the most interesting records of climbing and exploration which have appeared for a long time. Sir Martin Conway, as our readers are well aware, is an experienced mountaineer, and in this expedition to the Bolivian Andes he had with him two first-class Alpine guides, Antonio Maquignaz and Louis Pellissier. The narrative shows that among the Bolivian Andes they needed and evinced the same self-control, *sang froid*, fertility of resource, and power of endurance which are required in ascending the more dangerous of the Alpine peaks. But the perils and difficulties peculiar to mountaineering were by no means the only troubles the party had to meet and overcome. They had to deal with suspicious and obstructive local authorities, and what might have been worse, viz., superstitious and savage Indians, by whom the setting up of a theodolite or the taking of an astronomical observation was construed into an insult to their deities or a defilement of the ancestral sepulchres. It says much for the tact and courage of Sir Martin and his guides that they accomplished as much as they did with no worse collision between them and their surroundings than the comic arrest of Pellissier for some unknown local offence, which ended in his compounding a fine of five dollars by a payment of eighty cents.

Sir Martin and his guides succeeded in reaching the summit of Illimani, which he found to be 21,200 feet in height. He unfortunately failed to reach the top of Ankohuma owing to bad weather. The story is, of course, in the first instance one of mountain exploration, but in addition to this we have graphic descriptions of the present condition of the Panama Canal, and much useful information as to the mining and rubber industries of Bolivia. Minor incidents to amuse the reader are numerous, such as an attempted revolution and a surveying expedition which aroused the anger of the Indians, and might have ended fatally to Sir Martin and his guides. All of these are narrated in an easy and graceful style which adds considerably to the attractions of the book and increases its interest to the general public. We must also add that there are several excellent illustrations.

Surrey. By Walter Jerrold. London: J. M. Dent and Co., MCMI. *Price* 4*s.* 6*d.*

If any of our readers contemplate for next season a walking or cycling tour in Surrey, they could not do better than consult and take with them this volume of Dent's "County Guides." It is by no means merely a glorified Baedeker, although it is an excellent guide in the Baedeker sense. The writer shows a considerable acquaintance with the byways as well as the highways of the history of the many famous towns and villages which abound in Surrey, and his quotations from the literature which illustrates his subject are apt and effective. Part II. contains chapters on the birds, flowers, entomology, and geology of Surrey, which will probably be a revelation even to those who have lived there all their lives.

Historical Geography of the British Colonies. By C. P. Lucas, C.I.E. Vol. v. Canada. Part I. New France. Oxford: The Clarendon Press, MDCCCCI. *Price* 6*s.*

This is an excellent compendium of the history of Canada from the earliest times down to the Treaty of Paris in 1763 A.D., when it finally passed into the

hands of the British. The feature of the work is a skilful endeavour to show how the geography of the country affected its history. "Canada, within its ancient limits, was a network of inland waters: a continent to be conquered and settled by water rather than land, and the congenial task of conquering it and attempting to settle it was allotted by providence to the French." How the French succeeded in conquering it but failed to settle it and finally lost it is set forth in an interesting and instructive narrative, skilfully condensed, but with sufficient details. The selfishness and short-sighted errors of the European governments are neither ignored nor unduly exaggerated, and fitting justice is done to the memories of such statesmen and soldiers as Champlain, La Salle, Frontenac, Wolfe, and Montcalm. Part II. will deal with the history of Canada during the last hundred and forty years.

Our Empire Past and Present. By the Earl of Meath, M. H. Cornwall Legh, LL.A., and Edith Jackson. London: Harrison and Sons, 1901. *Price 7s. 6d.*

The volume now before us is the first of five which are to deal with the important subject of the British Empire. Unquestionably for some time past imperialism has been in the air, and the unexpected offer of the British Colonies to take a prominent share of the imperial burden in the South African war astonished not only England but the civilised world. How cordially the offer was accepted, and how gallantly it was redeemed is now a matter of history, but the history is only beginning. The authors of this series "desire to increase the prevailing knowledge of our imperial heritage, that its value may be enriched by intelligent endeavour and patriotism on our part and on our children's part after us." The present volume deals with the British Empire in Europe, and its keynote is, of course, the growth of England's sea-power. We have sketchy but well-written chapters on imperial progress and the growth of freedom and good government at home, followed by more elaborate chapters on the growth of our sea-power. After these come brief notices of the unions with Wales, Scotland, and Ireland, and the principal events in the history of the Isle of Man and the Channel Islands. The last chapters of the book are devoted to our Mediterranean possessions, Gibraltar, Malta, and Cyprus. Considering the space at the disposal of the authors, the work has been well done, and forms an excellent introduction to the subject for those who care to pursue it in more elaborate detail.

Rambles round the Edge Hills and the Vale of the Red Horse. By the Rev. George Miller. London: Elliot Stock, 1900.

The district described in this charming little volume, though not much frequented by tourists, is nevertheless the most picturesque to be anywhere found in the midlands of England. The Edge Hills which form part of the central tableland of England, rise from the upper valley of the Cherwell, and abruptly terminating at the villages of Tysoe, Radway, and Warmington, descend with a fall of 300 feet to the valley of the Red Horse, so called from the figure of a gigantic horse which had been carved on the slope of the hill above Tysoe, in imitation of the White Horse carved on the Berkshire hills. Throughout the volume, which is written in an easy and agreeable style, we are entertained not only with descriptions of the towns or rather villages in the district and of the scenery in the midst of which they are set, but also with much historical and archæological information regarding the churches, monasteries, manors, manor houses, and manorial families of

each parish. The author writes with an intimate personal knowledge of his subject, and presents not a few curious facts which he has derived from an examination of old records, some of which extend backward to pre-Norman times. In the body of the work a chapter is devoted to a detailed account with plans of the battle of Edge Hill fought between Charles I. and Lord Essex soon after the outbreak of the Civil War. Facts are here pointed out which show the statement to be untenable that the royal forces were defeated and driven back to the hills. In the appendices will be found a collection of facts which gives us an insight into the nature of English rural life in the olden days. Among the illustrations, which are but few, is a picture of Compton Wyniate's House, which for several generations was the favourite seat of the Earls of Northampton. In perusing the volume we desiderated a map of the district under description.

Les Nouvelles Sociétés Anglo-Saxonnes: Australie, Nouvelle Zélande, Afrique du Sud. Par PIERRE LEROY-BEAULIEU. Nouvelle édition entièrement refondue. Paris: Armand Colin, 1901. Pp. 487. *Price* 4 *fr.*

In the second edition of this interesting work the author speaks gloomily of the future of Australia owing to probable Labour troubles, and considers that Britain will eventually lose South Africa by the children or grandchildren of the defeated Boers wresting it from her. He is not surprised at the duration and magnitude of the present war. "The nature," he says, "of a war between Britain and the Boers was clearly demonstrated by the geography and history of the country." The author blames the British Government for undervaluing the military resources of the Boers, forgetting that Sir John Robinson, late Premier of Natal, confessed in a recent publication that even the Natal Government, "like the rest of South Africa, failed to grasp the magnitude of the peril that threatened both the Colonies and the Empire." (*A Lifetime in South Africa.* London: Smith, Elder, and Co., 1900., p. 328.)

After a glowing description of the war, in which he extols the heroism of the Boers and denounces the inhumanity of the British, the author reaches a climax by stating that Lord Roberts handed over the command to Lord Kitchener, "the butcher of Omdurman!" M. Beaulieu, who is neither a military man nor was present during the war, has apparently never read the opinion of the Austrian officer, Count Sternberg, who served with the Boers, and who wrote, "I may say that never has a war been fought in so civilised a manner."—(*My Experiences of the Boer War.* London: Longmans, Green, and Co., 1901, p. 210.)

With regard to the British Empire, however, the author fully recognises its grandeur. "The British Empire," he says, "is the greatest which has ever existed. Its area is three times that of Europe, and exceeds the fifth of the total land-surface of the globe, leaving far behind the territories, however vast, of Russia, China, the United States of America, and Brazil. Its population is probably slightly less than that of the Celestial Empire, but it is nevertheless a fourth of that of the world. . . . The sea being British, according to every Englishman's belief, and the British navy being omnipotent, the ocean unites instead of separating the scattered portions of the British Empire. Great Britain is at home on the waterways which lead to her dependencies, and can either prevent other Powers from communicating with theirs or throw a thousand obstacles in their path. This is what essentially differentiates the British Colonial Empire from any other, for Great Britain being mistress of the seas, communication between the various parts of her Empire is always as assured as if they formed one continuous territory."

Norway. Official Publication for the Paris Exhibition, 1900. Christiania, 1900: Edited by STEN KONOW and KARL FISCHER. Pp. xxxiv + 626.

The principle of the widow's mite is one of not unusual exemplification in the Budgets of the Nations, and it is often to the less wealthy countries that we have to look for examples of wise liberality in the domains of science and literature. The publication of the volume now under review is a case in point.

In 1899, principally in view of the proposed Norwegian participation in the Paris Exhibition of the following year, the Storthing passed a vote for the publication of a work dealing very exhaustively with the resources of Norway. The editing was placed in the judicious hands of Mr. Sten Konow and Mr. Karl Fischer, who divided the book into sections, and arranged for the services of specialists in the various departments. The result lies before us in this handsome volume.

The first four chapters deal with the situation and physical conditions of the western portion of Scandinavia; and a sketch-map of the peninsula brings out very prominently that broad belt of uninhabited and uninhabitable plateau, which occupies its medial region, and which accounts for so much in the relations of its eastern and western coastlands both in the past and in the present.

In the chapter on the topography of the country a very full account is given of the predominant influence of land-ice in determining its present features. The fact is noted that there, as in the Highlands of Scotland, the ice-shed lay some distance to the east of the present watershed; and attention is drawn to the economic importance of the raised beaches—in regard to which also an interesting analogy can be found in our own country. Perhaps the connection of the Norway Deep with the ice-flow is somewhat exaggerated, for it can hardly be doubted that this depression existed in pre-glacial times. There are several good views of Norwegian scenery showing the rounded outlines due to glaciation, and it is instructive to compare with these the sharp Alpine outlines of the Lofoten Mountains (pp. 356 and 360) which, although within the Arctic Circle, lay so far out from the main *massif* and so surrounded by the ocean as to escape most of the terrific grinding to which their more eastern neighbours and the lower elevations were subjected.

The chapters upon the geology, botany, and zoology of the country—contributed by Dr. Reusch, Mr. Gran, and Mr. Grieg—are, as might be expected, well done, and convey a considerable amount of information in small compass. Indeed one could wish that these subjects were dealt with in somewhat fuller detail.

It will probably be a surprise to the ordinary reader to see the non-Aryan proportion of the population (apart from the Lapps and Finns) estimated at one-quarter, and in the Stavanger district even at three-quarters. It may be noticed, however, that there is not complete harmony among the writers upon this point. Mr. Hansen rejects without hesitation the view that the whole of Scandinavia was formerly occupied by races of Lapp affinities, and believes that these peoples invaded the peninsula at a later date than either of the two main ethnical types.

The historical chapters necessarily contain some disputable matter, especially in those portions which deal with recent events. But it may be said that the questions at issue between the two Scandinavian kingdoms are generally stated with considerable fairness, although, of course, from the Norwegian point of view.

It is impossible to refer to each of the forty chapters into which this exhaustive work is divided, and we can only draw attention to the sections on Social Con-

ditions, Education, Forestry, and Fisheries, which are specially instructive and suggestive. It may be of interest at this moment to remind the Scottish reader that no fees are payable for the teaching in the University of Christiania. The chapters on literature and painting—the latter with examples of typical pictures—are also interesting.

The translation is excellent, and there are useful maps illustrating respectively the Geology, Climate, Distribution of Population, and Forest Areas. The general map is unfortunately on rather a small scale 1 : 3,600,000. The well-executed illustrations have been already referred to.

Altogether this volume reflects great credit alike upon the Government which authorised and supported it, and upon the editors and contributors by whom the work has been carried out. It will be a mine of information to all who are interested in Norway and the Norwegians, that is, to all who have visited, or who hope to visit, that fascinating land.

The Malvern Country. By B. C. A. Windle, D.Sc., F.R.S., F.S.A. London : Methuen and Co., 1901. Pp. 236. *Price* 2*s.* "The Little Guides" Series.

Guidebooks are fortunately now being written not merely by strolling enthusiasts but by scientific men well versed in the archæology, history, geology, and geography of the localities they describe. Such a Guide as this of Mr. Windle's may be taken as a type of the Guidebook which intelligent tourists would wish to possess, and we heartily commend it. We note the pretty inset map giving the "View from the Malvern Hills" as at once practical and satisfactory.

NEW MAPS AND CHARTS.

EUROPE.

SCOTLAND. CHARTS. Firth of Forth, No. 114*a*, Corrections to 1899. *Price* 2*s.* 6*d.*
Loch Broom, Upper Portion, No. 3192, September 1901. *Price* 2*s.* 6*d.*
Admiralty Office, London.

The chart of Loch Broom is new, and a creditable piece of work : but that of the Firth of Forth dates as far back as 1852, and, although the last edition is said to have been revised in 1899, it is very much out of date, and does not even show the new docks at Leith, or Portobello pier. This chart is not a credit to the Firth of Forth or to the Admiralty.

HARROGATE DISTRICT. Bartholomew's Reduced Ordnance Survey. Scale 2 miles to an inch. Sheet 6. *Price* 1*s.*, *on cloth* 2*s.*

SHEFFIELD DISTRICT. Bartholomew's Reduced Ordnance Survey. Scale 2 miles to an inch. Sheet 9. *Price* 1*s.*, *on cloth* 2*s.*

LINCOLN FENS. Bartholomew's Reduced Ordnance Survey. Scale 2 miles to an inch. Sheet 14. *Price* 1*s.*, *on cloth* 2*s.*

SWANSEA DISTRICT. Bartholomew's Reduced Ordnance Survey. Scale 2 miles to an inch. Sheet 27. *Price* 1*s.*, *on cloth* 2*s.*
John Bartholomew and Co., Edinburgh.

The above are new sheets of Mr. Bartholomew's new map of England and Wales. They are orographically coloured with cycling roads marked in brown.

GLASGOW. Exhibition Plan of ——. Showing tramway and railway routes, with plan of Exhibition grounds, etc. Scale 6 inches to a mile. *Price* 6*d.*
W. and A. K. Johnston, Limited, Edinburgh.

LONDON. Tape Indicator Map and Visitor's Guide. Scale 2½ inches to a mile. *Mounted on cloth, and in case. Price* 4*s.* *C. Smith and Son, London.*

MANCHESTER TO SALFORD. New Plan by J. Bartholomew. Scale 6 inches to a mile. With Index to Streets. *Price* 1*s.*, *cloth* 2*s.*
W. H. Smith and Son, London.

GRÆCIA. Murray's Handy Classical Maps. Edited by G. B. Grundy, M.A., Brasenose College, Oxford. Scale 1 : 633,600. In 2 Sheets. With Index. *Price* 1*s.* 6*d.*, *on cloth* 3*s.* *John Murray, London.*

This new map of Greece, edited by Mr. Grundy, Lecturer on Classical Geography at Oxford, and produced by Messrs. Bartholomew of Edinburgh, is unquestionably the finest classical map of Greece yet published. The outline is from the latest surveys, and coloured orographically.

ASIA.

ARMENIA and Adjacent Territories. By K. E. B. Lynch, M.A., and F. Oswald, B.Sc. Compiled by W. Shawe, 1901. Scale 1 : 1,000,000, or 15·7 miles to an inch. *Price* 10*s.* 6*d.* *Edward Stanford, London.*

This is an important new map of the Russo-Turkish frontier country. The Russian area is based on the Russian official surveys, the Turkish area upon Mr. Lynch's surveys and notes, while the Turco-Persian frontier is from English and Russian military surveys.

CHIHLI. Preliminary Maps, China Field Force. Scale 2 miles to an inch. 24 Sheets. 1901. *Zincographed at the Survey of India Offices, Calcutta.*

These maps are the preliminary issue of surveys made by the British Expeditionary Force to Peking in 1900. They include all the country between Peking and the Gulf of Chihli.

PALESTINE. Topographical and Physical Map. Prepared under the direction of J. G. Bartholomew, and edited by Professor George Adam Smith, D.D., LL.D., etc. Scale 4 miles to an inch. 1901. *Price, mounted on cloth and in case, with Index*, 10*s.* 6*d.* *T. and T. Clark, Edinburgh.*

This is a new map, prepared from the English and German Palestine Exploration Surveys. The scale of four miles to an inch, on which it is drawn, is perhaps the smallest adequate to show all requisite detail with precision and clearness. The physical features are effectively shown by contour colouring. Biblical names are in bold lettering, and the modern names in smaller characters. Besides meeting the special requirements of the student and the teacher, the map should appeal to tourists in Palestine, as it shows all modern roads, railways, and places of interest. The Index gives the modern as well as ancient name of each place, with cross references.

AFRICA.

CONGO. Carte de l'État Indépendent du ——. Dressée par A. J. Wauters. Scale 1 : 2,000,000. 4 Sheets. October 1900.
Mouvement Géographique, Bruxelles.

This map represents the surveys of the Congo State to date of publication, but it does not include the work of Major Gibbons.

EGYPTIAN SUDAN. War Office Map of Africa. Scale 1 : 250,000, or about 4 miles to an inch. 1901. District Sheets—Murrat, Wadi Halfa, Wadi Keheli, Nasser, Goré, Kosha, Akobo, Setit, Kassala, Middle Sobat, Dongola. Reproduced from maps supplied by the Director of Sudan Surveys. *Price 2s. 6d. each.* *Intelligence Division War Office.*

These sheets are some of the first of a projected new military map of Africa, on the scale of four miles to an inch. They represent all that is known of these regions, and form a most valuable basis for future mapping. After the rapid issue of such an important work, the Intelligence Division of our War Office can no longer be reproached for inactivity in map-making.

PORTUGUESE HYDROGRAPHIC CHARTS. Archipelago de Cabo Verde. Escala 1 : 500,000. Beira, Porto Interior, 1 : 30,000. S. Vicente, Porto Grande, 1 : 20,000. S. Antas, Porto da Ponta do Sol, 1 : 10,000.
Commissão de Cartographia, Lisboa, 1900.

AMERICA.

UNITED STATES. Geologic Atlas, Folios containing Maps illustrating Topography, Historical Geology, Economic Geology, and Structure Sections, with Descriptive Text, for the following districts:—Washington, D.C., Monterey, W. Va., Bristol, Va., Walsenburg, Co., Spanish Peaks, Co., La Plata, Co., Colfax, Cal., Mother Lode, Cal., Tintic Special, Utah, Uvalde, Tex., Danville, Ill., Menominee, Mich., on Scales of one mile to an inch and two miles to an inch. *United States Geological Survey, Washington, D.C.*

These folios constitute ideal geographical monographs for the districts which they cover. The execution of the work approaches a perfection to which official publications in this country have not yet attained.

UNITED STATES. Topographic Sheets, on Scales of 1 : 62,500, or about one mile to an inch, and 1 : 125,000, or about two miles to an inch. *Price 5 cents each sheet.* (*The figures indicate the number of sheets received for each State.*) Alabama (2); Arkansas (2); California (14); Colorado (2); Idaho (2); Illinois (7); Indiana (1); Indian Territory (18); Iowa (2); Kansas (2); Maine (2); Maryland (7); Massachusetts (1); Michigan (1); Montana (2); Nebraska (6); New Hampshire (2); New Jersey (9); New York (37); New Mexico (1); North Dakota (1); Ohio (9); Oregon (2); Pennsylvania (8); South Dakota (7); Tennessee (2); Texas (1); Vermont (2); West Virginia (2); Washington (8); Wisconsin (7); Wyoming (6); Yellowstone National Park (4). *United States Geological Survey, Washington, D.C.*

The publication of the above sheets shows that rapid progress is being made with the new topographic map. Compared with 1 inch and ½ inch maps of this country, the drawing is very open and clear, but the same amount of detail is

not attempted, and of course in a new country there is not the same amount of detail to map. The greater part of the country is on the scale of two miles to an inch, but thickly settled and industrially important parts are on the scale of one mile to an inch, while the desert regions of the Far West are on the scale of four miles to an inch. The water features are printed in *blue*. The relief is shown by contour lines printed in *brown*—the lines being drawn at intervals of from 10 to 200 feet, according to the character of the country shown. The works of man – cities, roads, railways, etc. are shown in *black*, in which colour all lettering is printed.

UNITED STATES. Maryland, Physical Atlas of —— . Alleghany County. Scale 1 : 62,500. 6 Sheets. W. Bullock Clark, State Geologist.

Maryland Geological Survey.

This publication is similar to the folios of the Geologic Atlas of the United States. Three of the plates are topographic and three deal with geology and soils.

UNITED STATES. Rand M'Nally and Co.'s Indexed County and Township Maps—Alabama, Arizona, Arkansas, California, Colorado. 1901. 25 *cents each.* *Rand M'Nally and Co., Chicago and New York.*

The above are new editions of Messrs. Rand M'Nally's useful series of state maps. The population is given for towns and counties according to 1900 census.

NEW ATLASES.

COLONIES FRANÇAISES, Atlas des ——. Dressé par ordre du Ministère des Colonies par Paul Pelet. Livraisons 1-7. *Price 3 francs each part.*

Librairie Armand Colin, Paris.

This Atlas, constructed by order of the Minister of the Colonies, is a valuable and important addition to French cartography. It consists of twenty-seven folio plates showing the various colonies on scales varying from 1 : 1,000,000 to 1 : 3,000,000, with inset maps of smaller islands on scales of 1 : 250,000 and 1 : 300,000. The work is beautifully executed after the style of the War Office Map of France—the land names being in black, water names in blue, hills in brown, with roads and railways in red. The maps are accompanied by descriptive and statistical text which deals very thoroughly with the commercial geography of the colonies.

THE TWENTIETH CENTURY CITIZEN'S ATLAS, containing 156 pages of Maps and Plans, with an Index, a Gazetteer, and Geographical Statistics. Edited by J. G. Bartholomew. Parts 1 and 2. *Price 6d. each part.*

George Newnes, Limited, London.

This is a new and enlarged edition of the Citizen's Atlas published in 26 parts. It has been remodelled, greatly extended, and thoroughly revised. Judging from parts 1 and 2, it has many new and interesting features to commend it, and promises to be one of the most popular standard atlases.

PHOTOGRAPHS. Royal Observatory, Cape Town. Part of Grounds of the Royal Observatory, Cape Town. *Presented by Colonel Bailey.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE GREAT SALT LAKE.

By Professor James E. Talmage, Ph.D., F.R.S.E., etc.

HISTORICAL AND DESCRIPTIVE.

The Great Salt Lake is a body of natural brine occupying the main depression within the Salt Lake valley in the north-central part of the State of Utah.

From the earliest announcements of its existence the lake has been an object of attraction to scientist and layman alike; and its claims to popular notice have increased with the passing years. At the present time the interest with which it is regarded is greater than usual owing to a surprisingly rapid shrinkage during the past two years, and to the many unfounded prognostications that have appeared in print telling of the certain disappearance of the lake within a few decades.

The earliest accounts accepted as having reference to the Great Salt Lake and to the peculiar properties of its waters date from 1689, when Baron La Hontan, a distinguished French traveller and explorer, learned from the Indian tribes of the Mississippi valley the story of a great salt sea lying high amid the solitudes of the western mountains. La Hontan published an account of these traditions, and the first English version of his narrative appeared in 1735. The water-body described to him by the copper-coloured aborigines may or may not have been the Great Salt Lake; but as such it is usually regarded.

From 1776, however, dates more reliable information. In that year Padre Escalante, a Spanish official and explorer, followed the Provo river from its upper parts to its termination in Utah lake, situated in the valley immediately south of that of the Great Salt Lake. From the Indian tribes who claimed as their particular domain the basin of the

Provo (by Escalante named Purisima river), and who were specifically known as the Timpanogotzis, the explorer learned of a lake covering many leagues with water extremely noxious and salty, lying in the valley northward. Escalante appears to have placed little credence in the Indians' stories, or else he considered the lake as of small importance; for, though but a day's travel would have brought him within sight of the salty sea, he contented himself with the red men's account, and made no attempt to confirm or disprove the same.[1]

As to the first white man who visited and really discovered the Great Salt Lake, perhaps the truth may never be known. Prior to 1833 numerous traders and trappers are said to have reached the shores; among them are Miller of the Astor Company; Provost (after whom Provo city, the capital of Utah county, has been named); Colonel James Bridger, for whom strong claims of the honours of discovery are made; and Captain Benjamin L. E. Bonneville.

That the last-named reached the lake and prosecuted extended explorations is beyond doubt. He wrote much by way of description, and his record has proved of value. Washington Irving's account, published under the title, *Adventures of Captain Bonneville*, has found a place in the treasury of American literature. Many attempts have been made to name the lake after Captain Bonneville; Washington Irving strove to accomplish this, and the Captain himself threw aside his native modesty and aggressively laid claim to the honour; but the appropriateness of the name, Great Salt Lake, was too plainly apparent to be disregarded. In 1876, however, Grove Karl Gilbert, of the United States Geological Survey, gave the name Lake Bonneville to the ancient sea of which the Great Salt Lake is the lineal descendant.

Bridger claimed to have followed the Bear river to its mouth, and to have navigated the briny waters of the lake, in settlement of a wager as to the course and termination of the river named. Then in 1843, a decade or more after the time of Bonneville's expedition, John C. Fremont, brevet-captain U.S. Army, sighted the lake from an elevation in Weber county on the north, and regarded himself as the first white man to gaze upon this mountain-girt sea. In his description he likened himself to Bilboa discovering the Pacific. Fremont reached the lake and explored some portions by the aid of row-boats; but he was by no means the first to navigate its waters. Fremont's visit was made in connection with a government expedition to the Rocky Mountains, and his report,[2] published by the United States Government, is perhaps the earliest reliable record of the physical conditions of the region.

In 1850 Captain Howard Stansbury, U.S. Army, at the head of a government expedition, completed a course of valuable work, comprising

[1] A translation of parts of the original manuscript journal of Padre Escalante, describing his visit to the Provo river and Utah lake in 1776, appears in Captain J. H. Simpson's report of *Explorations across the Great Basin of the Territory of Utah, etc.*, issued from the Government Printing Office, Washington, 1876. The translation is that by Philip Harry.

[2] *Report of the Exploring Expedition to the Rocky Mountains in the year* 1842, *and to Oregon and North California in the years* 1843-44, by Brevet-Captain J. C. Fremont. Washington, 1845.

a partial survey of the lake and contiguous region, determination of depth, density, and composition of the water, and a careful mapping of the shore line.[1]

Prominent among the investigators who have contributed to our knowledge of the modern lake is Grove Karl Gilbert, who, in connection with the work of the United States Geological Survey, has made a masterly study of the water-body itself, more particularly, however, in relation to its past history.[2]

During the period of human occupancy the lake region has been the subject of much individual study, and reliable information has been placed on record; though the contributions of this class are desultory and scattered, and most of them are practically inaccessible. Unfortunately there is no reliable work within general reach treating this remarkable water-body with the fulness its importance deserves;[3] and, in consequence, many errors have found their way into the unauthentic and popular literature of the subject. Cyclopedia articles and even text-book paragraphs show persistent citations of the lake water composition based on analyses made half a century ago; and the fiction that no living thing can exist in the lake brine is reiterated in the face of sure knowledge to the contrary.

The Great Salt Lake of the present day appears as an irregular water-body, lying with its greatest length approximately north-west and south-east. It fills the lowest parts of the Salt Lake valley, washes the margin of the Great American Desert on the west, and is confined by the parallels 111·8° and 113·2 longitude west from Greenwich, and by the lines 40·7 and 41·8 north latitude. It is the largest inland water-body within the confines of the United States west of the Mississippi valley. Subject as it is to great fluctuations in volume owing to the varying relation of supply by precipitation to loss by evaporation, and possessing but small depth with its marginal portions strikingly shallow, its surface area is of necessity inconstant. In consequence, the recorded dimensions vary greatly. The figures now generally accepted are as follow:—length, 75 miles; maximum width, 50 miles; area, 2125 square miles. It is practically certain that these data are excessive, but as no complete survey of the lake has been reported since 1869, the present dimensions cannot be given with assured accuracy. The existing shore line is near that of 1850, when, according to Stansbury's map, the lake covered but 1750 square miles.

The valley floor, on the lowest part of which the lake rests, is conspicuously flat, so that a slight fall of the water level gives rise to what appears to be a disproportionately great recession, and a rise of a few feet would result in flooding the valley nearly to the Wasatch bench

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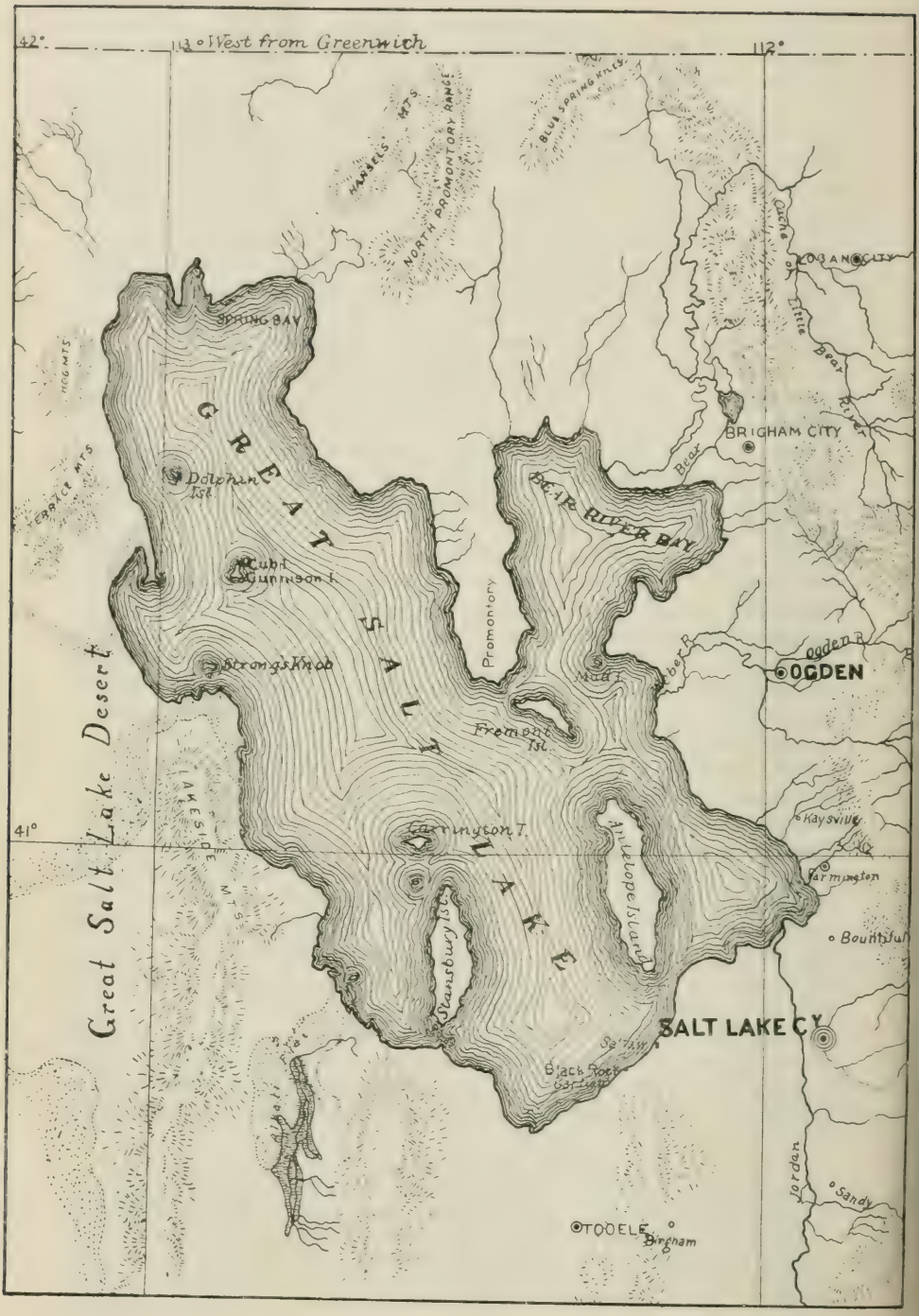
[1] *Exploration and Survey of the Valley of the Great Salt Lake of Utah, etc.*, by Howard Stansbury, Capt. Corps Topographical Engineers, U.S.A. Philadelphia, 1852.

[2] Monographs of the U.S. Geological Survey, vol. I.—*Lake Bonneville*, by Grove Karl Gilbert. Washington, Government Printing Office, 1890.

[3] For a brief and generally popular treatment see *The Great Salt Lake, Present and Past*, by James E. Talmage. Salt Lake City, Utah, 1900.


42°
113° West from Greenwich
112°
HANSELS MTS
NORTH PROMONTORY RANGE
BLUE SPRING KNLS
LOGAN CITY
Little Bear River
BRIGHAM CITY
Bear
SPRING BAY
HOG MTS
GRACE MTS
GREAT SALT LAKE
Dolphin Ist.
Rubi
Gunnison I.
Strongs Knob
BEAR RIVER BAY
Promontory
Hoar
Fremont Ist.
Ogden R.
OGDEN
Great Salt Lake Desert
41°
Carrington I.
Antelope Island
Stansbury Ist.
Kaysville
Farmington
Bountiful
SALT LAKE CY
Black Rock
Jordan
Sandy
TOOELE
Birgham

lands, and in the resubmergence of a considerable part of the Great American Desert.

A bold peninsula, known as the Promontory, projects into the lake about midway along its north-eastern shore. This is of true mountain structure, and, geologically considered, is part of a range the continuation of which appears in Fremont and Antelope islands, and, beyond the southern extremity of the lake in the Oquirrh mountains. Antelope island is the largest of the land masses rising from the lake; next in order of size is Stansbury island, and among the smaller masses are Fremont, Carrington, Gunnison, Dolphin, Mud, and Hat islands, and Strong's Knob.

In the early days of the settlement of Utah, Antelope and Stansbury islands were readily accessible by fording, and were utilised as herd grounds; later the lake rose, and the crossing had to be effected by boats. For two years past boats have been again unnecessary; and during the last few months the writer has repeatedly crossed from the mainland to the islands, sometimes on horseback, at other times in a light carriage, nowhere encountering water more than eight inches in depth. The route of such crossings lay over the bars or spits; but on either side of the shallows fording was practicable with a depth not exceeding three feet.

The river supply of the lake is all derived from the eastern side, and consists of a partial drainage from the Wasatch and Uinta mountains. From the western shore stretches the American desert with a few low ranges of hills, from which no permanent streams lead lakeward. Of the rivers that feed the lake, the first in importance is the Jordan, which brings down the overflow from Utah lake; next to this are the Weber and Bear rivers. Numerous smaller streams, locally known as creeks, render some contributions during the flood season of spring; but as the irrigation period progresses all the creek water is taken from its natural courses to be spread over the arable area.

Under conditions prevalent in more humid regions, such a diverting of the water from the stream courses would cause but a temporary cessation of the lake supply, for in time the land would become saturated, and the water would find a way to its natural reservoir through surface or subterranean springs. In the particularly arid region covered by the Great Basin, however, such a saturation appears eminently improbable, for the loss by surface evaporation has ever kept pace with the supply. A few small springs have been discovered emerging on the lake bed, or sending insignificant driblets from their in-shore mouths. It is interesting to note that the water of such springs is as a rule not strongly saline, though one of the springs supplies a positive brine, the salt content being probably derived from saliferous beds laid down in earlier stages of lake history.

The "Mormon" pioneers, who in 1847 were the first to push their way into these then desert wastes in search of a permanent home, have described the scene presented by this lake in the wilderness as forbidding in the extreme. They saw a seemingly sterile valley, walled in by mountains on all sides but one, the lowest portion occupied by a lake of

brine flanked by playas, salt marshes, and sites of desiccated pools; all of which told a disheartening story of an arid and barren soil. But they were hungry and footsore, weary with their forced march from the Missouri frontiers, weakened by the vicissitudes of desert camps and mountain journeys, yearning for the companionship of loved ones left behind, and eager in the search for an inviting home to which to welcome them on their later arrival. Those first colonists in the Great American Desert were scarcely alive to the more delicate impressions of landscape and water sheet, nor to the painted glories of the sun's rising and setting in this wild section of its realm; they looked primarily for the prospect of field and farm, of orchard, pasture, and home. And this they found with assuring promise, though it was only as the outcrop of an altered mineral vein upon the surface—all in prospect, nothing in present realisation. It required many decades of strenuous effort and taxing toil to transform the desert into its present garden site; and even now there is much of the wild grandeur of the wilderness about this salt sea with its valley setting.

The scenic glories for which the lake region is mostly famed depend not alone on mountain heights, or valley floor, neither on water expanse nor island cameos; not on one nor two nor all of these combined, pleasing though the combination be; these are but the canvas on which Nature paints with a richness beyond the colours of purely earthly origin. It is when the sunbeams fall aslant in the freshening dawn, or when the orb of day is sinking in the west, that the landscape and the water blaze forth with tints and shades which the artist strives in vain to catch and imitate.

A description of such a scene is a fit theme for the poet; the picture ought to be attempted by the master-hand alone. But the poet—frail as the rest of us—may substitute his witchery of rhythm and rhyme for the actual harmonies of the desert scene; and the painter may intrude his ideal into the picture. The truth here declared in Nature's language and colours calls for no embellishments. I trust rather the scientific observer, whose love for the beautiful, while no whit less than that professed and held by his brothers, poet and painter, is kept within the bounds of truthful decorum.

Let us call to our service the words of Professor Russell, whose geological researches in these and contiguous parts have afforded him abundant opportunity for observation.[1]

"The scenery about this great lake of the Mormon land and in the encircling mountains is unusually fine, in spite of the aridity and the generally scant vegetation of the region. The sensation of great breadth that the lake inspires, together with the picturesque islands diversifying its surface, and the utter desolation of its shores, give it a hold on the fancy and waken one's sense of the artistically beautiful in a way that is unrivalled by any other lake of the arid region. The unusually clear air

[1] *Lakes of North America*, by Israel C. Russell, Professor of Geology, University of Michigan. Boston: Ginn and Co., 1895, pp. 78, 79. See also *The Great Salt Lake, Present and Past*, by J. E. Talmage (1900), pp. 29-32.

of Utah, especially after the winter rains, renders distant mountains remarkably sharp and distinct, particularly when the sun is low in the sky and a strong side-light brings the sharp serrate crests into bold relief and reveals a richness of sculpturing that was before unseen. At such times the colours on the broad deserts and amid the purple hills and mountains are more wonderful than artists have ever painted, and exceed anything of the kind witnessed by the dweller in regions where the atmosphere is moist and the native tints of the rock concealed by vegetation. The hills of New England when arrayed in all the gorgeous panoply of autumnal foliage are not more striking than the desert ranges of Utah when ablaze with the reflected glories of the sunset sky. The rich native colours of the naked rocks are then kindled into glowing fires, and each canyon and rocky gorge is filled with liquid purple, beside which even the imperial dyes would be dull and lustreless.

"At such times the glories of the hills are mirrored in the dense waters of the lake, their duplicate forms appearing in sharp relief on the paler tints of the reflected sky. As the sun sinks behind the far-off mountains, range after range fades through innumerable shades of purple and violet until only their highest battlements catch the fading glory. The lingering twilight brings softer and more mysterious beauties. Ranges and peaks that were concealed by the glare of the noon-day sun start into life. Forms that were before unnoticed people the distant plain like a shadowy encampment. At last each remote mountain crest appears as a delicate silhouette, in which all details are lost, drawn in the softest of violet tints on the fading yellow of the sky.

"To one who only beholds the desert land bordering Great Salt Lake in the full glare of the unclouded summer sun, when the peculiar desert haze shrouds the landscape and the strange mirage distorts the outline of the hills, the scenery will no doubt be uninteresting and perhaps even repellent. But let him wait until the cool breath from the mountains steals out on the plain and the light becomes less intense, and a transformation will be witnessed that will fill his heart with wonder."

Fluctuations in Volume.

It is now very generally known that the Great Salt Lake is a diminutive remnant of an inland sea which once existed in the vales of Utah, filling the Salt Lake valley, extending beyond the present Nevada and Idaho boundaries on the north and west, and on the south nearly reaching the Arizona line. The eastern shore of this ancient water-body was determined by the Wasatch mountains to their southern extremity, thence by the series of plateaus which extend as a continuation of the Wasatch ridge, with an increasingly western trend through the southern portion of the State of Utah.

The existence of this early sea is declared by shore lines and terraces, both carved and built, by sea-caves, ripple-marks, and other littoral phenomena, on the mountain slopes that once formed its precipitous shores, and in the sediments of its desiccated floor. The extreme salinity which to-day characterises the waters of the lake is further evidence of

shrinkage by evaporation when considered in connection with the small area of the existing lake.

But the history of Lake Bonneville and its decrease in volume to the present limits of the Great Salt Lake is not the simple story of a single drying away. There were at least two periods of maximum flooding, separated by a long interval of particularly arid conditions, during which the lake almost or entirely disappeared. While the fluctuations during historic times are insignificant in comparison with those of the distant past, the lake now varies in volume from year to year through a range unusual with existing water-bodies. This is the natural consequence of the aridity of the region and the surprisingly high evaporation operating on a lake devoid of outlet.

The variations in surface area are even more striking than the changes in volume, owing to the littoral shallowness and the very gradual inclination of the bottom. Residents of the lake region testify from personal observation of a time when the eastern shore was two and a half miles inland from the present water margin; and ruins of fences are now to be seen a mile and a half from the existing shore, marking the limits of salt-grass pastures exposed by an earlier recession, then submerged, and now again left dry.

The earliest reliable map, constructed on the basis of efficient surveys of the lake, is that published in Stansbury's report, presenting the area covered by water in 1850. This period was that of the lowest level observed by civilised man prior to the great shrinkage now in progress. A second map was prepared by the geologists of the Fortieth Parallel Survey, under the direction of Clarence King, based on work done in 1869. At this time the water was approaching its maximum height during the period of human occupation. The first of these shows 1750 square miles of water area, the second 2170 square miles. As already stated, the present shore line is near that of 1850, as mapped by Stansbury's party, and the existing extent of water surface is correspondingly small.

No bathymetrical survey has been made, and the contour of the lake-bed is but imperfectly known. By soundings made in 1850 a maximum depth of 36 feet and an average depth of 13 feet were found. By 1869 the lake had risen so as to secure an extension of 470 square miles in area, though with an increase not exceeding 5 feet in average depth, and a maximum depth of 49 feet. This disproportionately small increase in average depth is due to the submergence of comparatively large areas of flat shore borders. By way of a probably safe estimate it may be said that the average depth of the lake to-day is not more than 13 feet. According to the incomplete data obtainable, the lake occupies a valley trough, with a trend slightly west of north and south of east, and approximately 25 to 30 miles in average width. This trough is nowhere more than from 30 to 36 feet below the water surface, and the slope from the edge of the depression to the level of the lake border is exceedingly gradual.

The existence of this central depression may give some comfort to the alarmists who predict the early drying away of the lake as suggested

by the recent recession of the waters. It is within the bounds of probability that should the current shrinkage continue until the marginal shallows have been left dry, and the lake waters be confined to the central trough, the evaporation from the diminished water surface may not exceed the supply, and the shrinkage would reach its limit for the present cycle of climatic conditions. This central trough is not filling up at any measurable rate by mechanical deposition. It is probable that a marly deposit is accumulating over the deeper parts of the lake-bed, but practically all the suspended matters brought down by the streams are dropped near shore. The water, except near the river mouths, is strikingly free from particles in suspension. The loss of transporting or supporting power through admixture of waters of different chemical contents is generally known; and in the case of the Salt Lake the meeting of the inflowing stream with the lake brine determines an immediate precipitation of the suspended particles.[1]

For an undetermined period prior to 1850 the lake had been falling; then during a few years the volume fluctuated, with a tendency to rise, and finally started on its upward course, reaching its greatest height about 1873. This relatively high level was followed by a cycle of recession varied by an occasional rise for a year or so, as one or more seasons of abundant precipitation prevailed, but with a prevalent tendency towards shrinkage. The low level of 1850 has again been reached.

A river bar constructed by the Jordan extends from the delta to Antelope island. Fremont records that in August 1845 he rode across the bar to Antelope island, the water in no part of the course reaching his saddle-girths.[2] As stated, the present writer has several times ridden or driven to the island *viii* this bar without encountering more than eight inches of water. This may not indicate a fall of the water below the level of 1845, for doubtless the bar has been raised by added deposition during the intervening years.

A bar in the form of a completed spit extends from Stansbury island to the mainland. This was dry during the summer months of 1850. From 1865 to 1898 the bar was never uncovered, though herds of cattle were driven across during the low-water period of most years. At present the bar is mainly dry, and in no part is it covered by more than a foot of water.

An annual oscillation, fairly regular as to recurrence but not as to range, has been observed, the maximum height being reached during May or June, and a lowest level during the late summer months. But fluctuations of greater than seasonal range are known to occur. Evidence from many sources points to the correctness of the statements made by Gilbert in 1878: 'Thus it appears that in recent times the lake has overstepped a bound to which it had long been subject. Previous to the year 1865, and for a period of indefinite duration, it rose and fell with the limited oscillation and with the annual tide, but was never

[1] See contributions by T. Sterry Hunt, *Proc. Boston Nat. Hist. Soc.*, 1874. See also *Text Book of Geology*, by Sir Archibald Geikie, third edition, p. 381, for treatment of subject and bibliography.

[2] Fremont's *Memoirs*, i. p. 431.

carried above a certain limiting line. In that year or the one following it passed the line, and it has not yet returned. The annual tide and the limited oscillation are continued as before, but the lowest stage of the new *régime* is higher than the highest stage of the old. The mean stage of the new *régime* is 7 or 8 feet higher than the mean stage of the old. The mean area of the water surface is a sixth part greater under the new *régime* than under the old."[1] This record has reference to conditions not later than 1878. Since that time the lake has not only returned to, but has fallen below, the limiting line of Gilbert's old *régime*.

Touching the arid conditions of the Great Basin in general, I venture to incorporate my own words used in another connection, with included quotations :[2]—

The aridity of the Great Basin is due to the very small precipitation of moisture and to the great evaporation resulting from the high temperature. Humid air currents travelling eastward from the Pacific suffer a condensation of their vapour before reaching the Basin ; when they arrive their condition is changed to that of drying winds.

An estimate of the energy of the evaporation process may be made as follows: The preparation of salt from the lake water constitutes at present an important industry. In the process of manufacture, the lake brine is pumped into elevated conduits through which it is conveyed to large ponds; in the ponds it evaporates without artificial heat. The pond area, the pump discharge per hour, and the length of time during which the pumps have to be worked in order to keep the water at the same level in the ponds, may all be determined. From the official reports of one of the salt companies, it is learned that their ponds cover 971 acres ; that the pumps discharge 14,000 gallons of water per minute, and that when the ponds have been filled, it is necessary to work the pumps to their full capacity from ten to twelve hours daily during the summer months in order to maintain the level. Making allowance at the start, as a guard against over-estimate, let us assume that the evaporating surface of the ponds is 1000 acres in area. At the rate of 14,000 gallons per minute, 8,400,000 gallons would be delivered in ten hours. This represents the loss by evaporation per day of 24 hours. Considering the lake surface to be 2125 square miles—the usually accepted area—the rate of evaporation shown above would indicate a daily removal from the lake of 11,424,000,000 gallons of water, or 342,720,000,000 gallons per month of 30 days. The weight of the water so lifted is 95,447,916 tons per day, or 2,863,437,500 tons per month. The same high rate of evaporation continues through at least three months of the year. The estimate here indulged in is founded on the unproved supposition that the rate of loss is the same over the deep parts of the lake body as from the shallow pond waters; it is evident indeed that such cannot be the case; but even if the numbers would more nearly represent the truth when halved, quartered, or divided by ten, the result is sufficiently astounding.

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[1] *Report on the Lands of the Arid Region of the United States, etc.*, by J. W. Powell. Washington. 1879, second edition, chapter iv., "Water Supply," by G. K. Gilbert, p. 66.

[2] *The Great Salt Lake, Present and Past*, by the writer, pp. 47-53.

As is now generally known, there has been a notable increase in the water supply of the Salt Lake valley, and indeed of the entire Basin Region, within the period of human occupancy. The supply keeps ahead of the demands of the growing population. By way of example, I cite the following items of traditional history, for which information I am indebted to the Historian's Office, Salt Lake City. Between 1850 and 1860 the site of the present town of Kaysville was first occupied for habitation. For years after the time of first settlement, a dozen families composed the entire population, and the settlers were loath to welcome additions to their numbers, owing to scarcity of water. The tiny creek, on the banks of which the diminutive and scattered village had been established, scarcely furnished water enough for the irrigation of the few small farms owned by the settlers. Kaysville now is a thriving little town with a population of over 1800. Similar conditions have prevailed in the history of other towns on the lake margin. Forty-five years ago ten families composed the population of Farmington and fourteen that of Bountiful. These places are at present prosperous towns, the first with over a thousand inhabitants, the second supporting over 2500 souls. The prevailing pursuit of the people is agriculture, and water is needed for every farm. Yet there is enough and to spare, and additions to the farming population are regarded as desirable.

To account for this remarkable increase in the water supply, numerous theories have been proposed, most of them meeting with temporary favour, soon to be lost. Of such theories three are generally current; these are called respectively, the volcanic theory, the climatic theory, and the theory of human agencies.[1]

The volcanic theory supposes the increase to be merely an apparent rise in the lake volume, and this is ascribed to orogenic disturbances, whereby the lake bottom has been deformed and the water caused to recede from some parts and to overflow others. The hypothesis is untenable in the light of the fact that the elevation of lake level is real, indicating an actual increase in the water volume. The water has risen along the entire shore line. On the islands and along the mainland margin old storm lines are now submerged, and everywhere the shore has been transferred inland. Independent observation confirms the belief that the rising of the lake is due to an increase in the water supply of the entire hydrographic basin, for the streams have all grown in volume to a degree commensurate with the lake growth. The water-body not only rose with comparative rapidity above a height which for an indefinite period had marked its maximum limit, but it maintained its higher level for more than a decade; and such a condition is not explicable on the supposition of a simple deformation of the bed. With reference to the general and actual rising of the water in opposition to any supposed increase which is apparent only, I quote from the *Lands of the Arid Regions*, page 67 :—

"The farmers of the eastern and southern margins have lost pastures and meadows by submergence. At the north, Bear River Bay has ad-

[1] *Lands of the Arid Regions*, p. 67.

vanced several miles upon the land. At the west, a boat has recently sailed a number of miles across tracts that were traversed by Captain Stansbury's land parties. That officer has described and mapped Strong's knob and Stansbury island as peninsulas, but they have since become islands. Antelope island is no longer accessible by ford, and Egg island, the nesting ground of the gulls and pelicans, has become a reef. Springs that supplied Captain Stansbury with fresh water near Promontory Point are now submerged and inaccessible; and other springs have been covered on the shores of Antelope, Stansbury, and Fremont islands."

The climatic theory refers the phenomenon of increase to a permanent change in the conditions controlling precipitation and evaporation within the drainage basin. While the recorded observations of rainfall are few, an actual increase in precipitation is indicated. An increase of less than ten per cent. would probably account for the observed phenomena, and the influence of climatic change appears to be a probable explanation, in part at least, of the greater supply.

Major Powell has advocated the claim of the theory of human agency. By the cultivation of the land, and the deforesting of the hill slopes, man favours the rapid removal of the precipitated moisture through the increase of stream volume. Well, covered soil retains the moisture whether it fall as rain or as snow, and in time returns it to the atmosphere through the medium of evaporation. The more completely the precipitated water is so held, the less reaches the lake through stream discharge; and conversely, as the streams are augmented the lake rises. Considering the theory of climatic change and that of human agency as the two hypotheses most worthy of credence, the writer of chapter iv. of *Lands of the Arid Regions* says:—

"On the whole, it may be most wise to hold the question an open one whether the water supply of the lake has been increased by a climatic change or by human agency. So far as we now know, neither theory is inconsistent with the facts, and it is possible that the truth includes both. The former appeals to a cause that may perhaps be adequate, but is not independently known to exist. The latter appeals to causes known to exist, but quantitatively undetermined. It is gratifying to turn to the economic bearings of the question, for the theories best sustained by facts are those most flattering to the agricultural future of the Arid Region. If the filling of the streams and the rising of the lake were due to a transient extreme of climate, that extreme would be followed by the return to a mean condition, or perhaps by an oscillation in the opposite direction, and a large share of the fields now productive would be stricken by drought and returned to the desert. If the increase of water supply is due to a progressive change of climate forming part of a long cycle, it is practically permanent, and future changes are more likely to be in the same advantageous direction than in the opposite. The lands now reclaimed are assured for years to come, and there is every encouragement for the work of utilising the existing streams to the utmost. And finally, if the increase of water supply is due to the changes wrought by the industries of the white man, the prospect is even better."

"Black Rock"; near southern extremity of the Great Salt Lake.

The increased water supply continues, though with some diminution, particularly within the last fifteen years; but the lake is steadily falling at a rate seemingly out of proportion to the lessened precipitation. The true and full cause of the recent and current shrinkage has probably not been wholly determined, though many of the principal factors are apparent. Since 1863 the lake level has been recorded in terms of a gauge-scale established by the U.S. Geological Survey at Garfield Beach, near the southern extremity. The zero of this scale was arbitrarily placed at what was supposed to be one foot below the lowest observed level. On the last day of 1900 the water stood nine inches below the zero of this scale. The cause of the great recession now in progress has become a question of supreme interest, and numerous answers have been proposed. Mr. L. H. Murdoch, Director of the U.S. Weather Bureau Station at Salt Lake City, writing under date of January 25, 1901, attaches prime importance to the supply by immediate precipitation, and practically ignores the deficiency of supply through diversion of the streams for irrigation purposes.[1] He has carefully tabulated the Bureau records of precipitation for three stations contiguous to the lake, viz., Salt Lake City, Ogden (thirty-seven miles north), and Corinne (fifty-five miles north of Salt Lake City), and has compared the readings with the record of lake level from year to year. The accompanying chart presents this comparison in graphic form, with some additions prior to 1863. I am permitted to incorporate here some of the data furnished by the Weather Bureau and used by Mr. Murdoch in his presentation. It appears that several notable instances of rise or fall in lake level have been preceded by years of excessive or deficient precipitation, measured from the normal for the region. The average annual precipitation for the stations named between 1863 and 1900 is 14·65 in. From 1863 to 1885 the average precipitation was 15·32 in., and throughout this period the lake rose. From 1886 to 1900—years of lake recession—the average precipitation was but 13·67 in., representing an annual deficiency of 0·98 in. This would amount to an accumulated shortage of 14·7 in. for the fifteen years ending with 1900, and during this period the lake fell from 9 ft. 2 in. (above the gauge zero) to 9 in. below 0°, or through a range of 9 ft. 11 in. The records show that the last fifteen years constitute the driest period of equal consecutive duration since the establishment of the Weather Bureau stations. I quote from Director Murdoch's statement: "The wettest fifteen consecutive years were those from 1864 to 1878 inclusive, with an average of 17·14 in.; and during this period the lake rose to a maximum height of about 13 ft. 5 in. in 1868, fell to a minimum of about 6 ft. in 1874, and reached a maximum height of about 12 ft. 5 in. in 1876. The rise of 1868 was preceded by 28 in. of rainfall in 1867; and the rise of 1876 by 20·45 in. in 1875."[2] He concludes that there

[1] See *Monthly Weather Review*, vol. xxix., No. 1, January 1901, p. 22. Washington, Weather Bureau.

[2] See *Monthly Weather Review*, vol. xxix., No. 1, January 1901, p. 23. Washington, Weather Bureau.

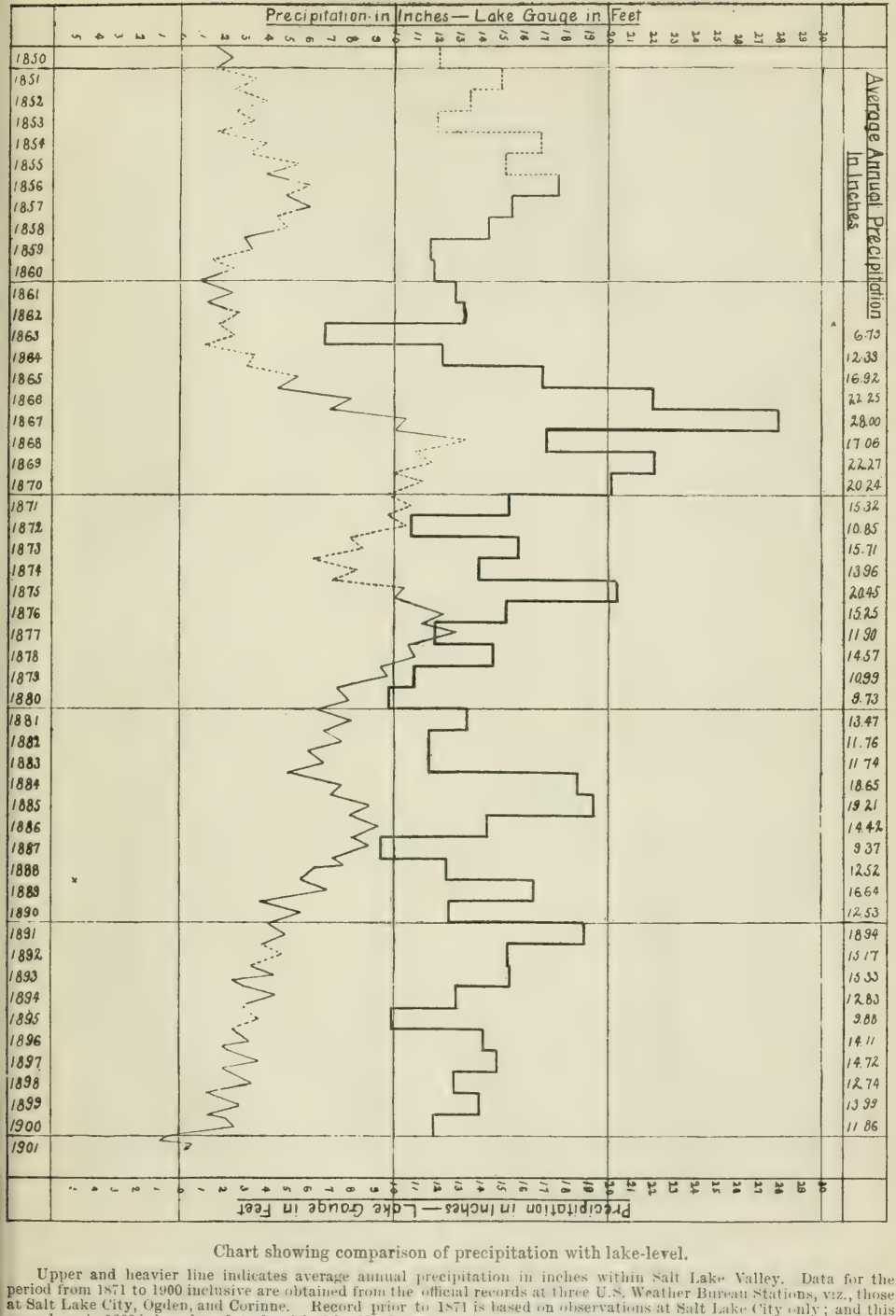

Chart showing comparison of precipitation with lake-level.

Upper and heavier line indicates average annual precipitation in inches within Salt Lake Valley. Data for the period from 1871 to 1900 inclusive are obtained from the official records at three U.S. Weather Bureau Stations, viz., those at Salt Lake City, Ogden, and Corinne. Record prior to 1871 is based on observations at Salt Lake City only; and this record up to 1863 is based on data furnished by Mr. Marcus E. Jones, Salt Lake City.

Lower lighter line shows lake-level in feet. The record is made according to data furnished by Mr. M. E. Jones for the period prior to 1875, and by the Oregon Short Line Railway Company from readings at the Garfield Beach gauge from 1875 to the present.

—— Dotted line in either case indicates approximations made according to the best data available.

is no indication of a change towards a permanent condition of greater aridity in the region; that a return to normal precipitation is probable; and that the lake will soon regain its level of fifteen years ago.

Commenting on Mr. Murdoch's statement, Dr. G. K. Gilbert admits the general accordance between the records of precipitation and lake level; accepts variations in precipitation as a true cause of lake fluctuation, but considers it insufficient. He regards diversion of the streams as a prominent factor contributing to the recent shrinkage, and holds that the full cause will be found to depend on many factors.

It has been further suggested that the lake rise, which began so soon after the settlement of the region, was in part due to the pasturing of animals in large numbers within the drainage basin. The effect was that the soil was tramped down, and by thus losing in surface porosity it permitted the water to run directly off, and the lake was the recipient of greatly increased contributions. The removal of the herbage by cattle, and the deforesting of the hill-slopes by man, further lessened the retention of rain-water and snow within the region. But cattle-pasturing in the lake-basin reached its limit and then declined, giving place to farming operations, in which the cattle ranges were converted into fields, the soil was turned and its absorbent power increased; less of the precipitated moisture ran off; and the lake suffered deprivation. This may be a true element of cause, but alone it is certainly inadequate as an explanation of the great fall in lake level.

From all evidence at hand it appears probable that the full cause of the current fall in lake level is dependent on a number of factors, but that the principal ones are deficiency of precipitation through a period of fifteen years, and increasing diversion of the stream water. In the dry atmosphere of the Great Basin, much of the water spread upon the land is lost from the surface by immediate evaporation, and but little finds its way to the lake reservoir through subterranean channels or by springs. But a small portion of the water lifted by evaporation within the basin area is precipitated again therein, the prevailing winds operating to carry it eastward.

If no climatic change toward greater precipitation ensue, present indications point to a continued recession of the lake until an area is reached the evaporation from which may be practically met by the diminished supply. This area, as stated, may be the central trough or depression holding the deeper waters. There is little ground for hope that the stream supply will be augmented unless a cycle of increased precipitation follow. Under existing conditions it is probable that even the flood-season contributions will be cut off, for the growing needs of irrigation are forcing the construction of reservoirs in the upper stream regions for the storage of the flood waters.

Composition of the Lake Brine.

A study of Lake Bonneville history makes the existing lake appear as the veritable dregs of the ancient water-body. The evidence is complete that from a level of about 600 feet above the present water surface

the lake has shrunk through desiccation alone. The solids brought down in solution by the inflowing streams have been progressively accumulating, while the water itself has been removed by evaporation at a rate equal to, and for long periods greater than, the supply. Much of the soluble matter left by the lake in its abandoned bottoms has been washed out and again carried into the lake at lower levels by the streams which persistently followed it in its retreat. Wide variations in solid contents with respect both to composition and quantity have been noted in the examination of samples taken at different times, and these variations are approximately commensurate with the fluctuations in volume.

The earliest published analysis of the lake water is that of Gale made on a sample collected in 1850, when the lake was at its lowest observed level prior to the present. The results appear in Stansbury's report.[1] This analysis showed 22·28 per cent. dissolved solids by weight. The next reliable determination was that made by Allen on water taken in 1869 when the lake was well on its way toward its maximum height for the then current cycle; this showed a total of 14·99 per cent. dissolved solids. In 1873 Bassett reported 13·42 per cent. solids; and the present writer has found 16·716 per cent. in 1885; 19·557 per cent. in 1889; 21·47 per cent. in 1892; 21·16 per cent. in 1894; and 21·39 per cent. in 1895. Since 1873 the water has been steadily increasing in density, and therefore in its content of dissolved solids, except for the seasonal variations. The data cited are here repeated in tabular form with other statistics.

Solid contents and specific gravity of water taken from the Great Salt Lake.

Date of Collection.	Specific Gravity.	Total Solids. Per cent. by weight.	Total Solids. Grams per litre of sample.	Authority.
1. 1850,	1·170	22·282	260·69	L. D. Gale.
2. 1869 (summer),	1·111	14·9934	166·57	O. D. Allen.
3. August 1873,	1·102	13·42	147·88	H. Bassett.
4. December 1885,	1·1225	16·7162	187·65	J. E. Talmage.
5. February 1888,	1·1261	...	...	J. E. Talmage.
6. June 1889,	1·148	...	...	J. E. Talmage.
7. August 1889,	1·1569	19·5576	226·263	J. E. Talmage.
8. August 1892,	1·156	20·51	238·12	E. Waller.
9. September 1892,	1·1679	21·47	250·75	J. E. Talmage.
10. 1893,	...	20·05	...	J. T. Kingsbury.
11. December 1894,	1·1538	21·16	244·144	J. E. Talmage.
12. May 1895,	1·1583	21·39	247·760	J. E. Talmage.
13. June 1900,	1·1576	20·90	241·98	H. N. M'Coy and Thomas Hadley.[2]
14. July 1900,	1·1711	22·89	268·09	H. W. Sheley.
15. August 1900,	1·1805	23·36	275·765	H. W. Sheley.
16. October 1900,	1·1860	24·03	285·020	H. W. Sheley.
17. September 1901,	1·1979	25·221	302·122	L. J. Seckels.

An apparent discrepancy exists between the writer's report on the

[1] *Exploration and Survey of the Valley of the Great Salt Lake of Utah*, by Howard Stansbury (Philadelphia, 1852), p. 212.

[2] Specific gravity determined by Dr. M'Coy; total solids by Mr. Hadley.

sample collected in September 1892 (No. 9) and the results obtained by Waller on a sample (No. 8) taken in August of the same year. The difference is greater than could be expected from the progressive concentration during so short an interval; though in fact, samples collected in August and September may show a wider variation than do those taken in any other two consecutive months. The discrepancy is probably due to an actual difference between the samples: they may have been taken from different parts of the lake. Care is necessary as to the place of taking the samples for analysis, as the water is by no means of uniform density throughout. Thus, in the line of the river mouths the brine is diluted to a distance of miles, while near shore the water shows a density above the average for the time. The results reported by the present writer, and those obtained by Hadley and Seckels (on water taken from the lake by the writer), are those yielded by samples collected in the open lake.

The data most commonly cited for decades past as showing the solid contents of the lake water are those presented by Gale. In 1889 the present writer published analyses of the water as then constituted, and protested against the excessive richness generally quoted, as at that time the lake was high and the brine relatively dilute. It was stated that it would be more nearly correct "to quote the average contents of the Salt Lake water at 16 per cent. solid matters than at 22 per cent." as at that time was most commonly done.[1] Now, however, the water has passed the density chronicled by Gale, and at present the dissolved solid matter constitutes about 25 per cent. of the weight of the brine.

The dissolved solids consist principally of sodium and magnesium salts with the chlorides predominating. Potassium compounds are also present, while boric and phosphoric acids are found in traces and lithium occurs in quantity sufficient to be readily detected by spectroscopic tests. Bromine has been found in traces, and in the later analyses this element is reported in measurable amount. Iodine has not been found.

The following table presents the results of a number of determinations :—

Composition of dissolved solids occurring in Salt Lake water, acids and bases theoretically combined; expressed in percentage of weight of samples.

	Gale. 1850.	Allen. 1869.	Bassett. 1873.	Talmage. 1885.	Talmage. 1889.
Sodium chloride, ...	20·20	11·86	8·85	13·586	15·743
Sodium sulphate, ...	1·83	0·93	1·09	1·421	1·050
Magnesium chloride, . . .	0·25	1·49	1·19	1·129	2·011
Calcium sulphate, . . .	...	0·09	0·20	0·148	0·279
Potassium sulphate, . . .	...	0·53	...	0·432	0·474
Potassium chloride, . . .	...	...	1·89	...	...
Excess of chlorine, . . .	...	...	0·20	...	...
Total, . . .	22·28	14·99	13·42	16·716	19·557

[1] See "The Waters of the Great Salt Lake," by the writer, *Science* (New York, 1889), vol. xiv. pp. 444-446.

A comprehensive analysis was made by E. Waller on water taken from the lake in August 1892. The results reported are as follow :[1]—

Analysis of a sample of the water of Great Salt Lake, collected August 9, 1892.

[Expressed in grams per litre; Specific Gravity, 1·156.]

Elements and Radicals.		Probable Combination.	
Sodium,	75·825	Sodium chloride NaCl,	192·860
Potassium,	3·925	Potassium sulphate K_2SO_4,	8·756
Lithium,	0·021	Lithium sulphate, Li_2SO_4,	0·166
Magnesium,	4·844	Magnesium chloride, $Mg Cl_2$,	15·044
Calcium,	2·424	Magnesium sulphate, $Mg SO_4$,	5·216
Chlorine,	128·278	Calcium sulphate, $Ca SO_4$,	8·240
Sulphur trioxide,	12·522	Ferric and aluminium oxides, $Fe_2O_3 + Al_2O_3$,	0·004
Oxygen in sulphates,	2·494		
Ferric oxide and aluminium oxide,	0·004		
Silica,	0·018	Silica, $Si O_2$,	0·018
Boron oxide,	Trace	Surplus sulphur trioxide, SO_3,	0·051
Bromine,	Faint trace	Total,	230·355
		Total solids by evaporation,	238·12
		Total solids [duplicate],	237·925

Waller reports no sodium sulphate, and in this respect his results differ from all other published analyses. The difference is one of theoretical consideration in the calculation of the probable combinations of acid and basic radicals. He has evidently combined all the sodium with chlorine as sodium chloride, which assuredly is the most abundant solid in the brine; but sodium sulphate is known to exist in the water, or to be plentifully formed under conditions of its easy separation. As shall be shown, every winter witnesses the deposition of enormous quantities of the sulphate, the separation taking place as soon as the water reaches a certain critical point of moderately low temperature. G. K. Gilbert estimates the quantity of sodium sulphate dissolved in the lake at thirty millions of tons.[2]

Additional data of a fragmentary character are gathered from a partial analysis made at the University of Utah by Mr. H. W. Sheley, on a sample taken in October 1900. This gave :—

Chlorine,	13·062 per cent. of weight of sample.
Sulphuric acid radical, SO_4,	1·586 ,, ,, ,,
Calcium,	0·487 ,, ,, ,,
Magnesium,	0·254 ,, ,, ,,
Bromine,	1·4 parts per million.

A sample taken in August 1900 yielded to Mr. Sheley 12·79 per cent. chlorine.

The composition of the stream water flowing into the lake is an interesting subject of inquiry in this connection. The principal streams have been examined and their residues analysed; as a result, an average of 0·2446 part solid matter per thousand is indicated. This is nearly double the average quantity of dissolved solids in rivers in general; and

[1] *School of Mines Quarterly* (Columbia College, New York), vol. xiv. p. 58.

[2] *Lake Bonneville*, Monograph I. U.S.G.S., 1890, p. 253.

the water from lake-shore springs is even richer in dissolved matter. Professor Russel estimates that the combined stream and spring waters reaching the lake carry 0·03 per cent. or 0·3 part per thousand. It is plain that but for the concentrating effect of evaporation the lake would be a fresh-water body.

The lake is approaching the condition of a saturated brine; already in the partly isolated shallows it has deposited salt as a floor crust in places sufficiently thick and coherent to sustain the weight of a horse and rider; but in the open area the water still holds its salt in permanent solution.

Analysis fails to reveal in the brine the proportion of calcium carbonate to be expected from the presence of this substance in the inflowing waters. This is accounted for by the immediate precipitation of most of the carbonate at the river mouths, and by the slow accumulation of a marly deposit farther out. The littoral deposits of calcium carbonate appear as spheroidal calcareous particles, particularly plentiful along the south and south-eastern shores. This is commonly known as "oolitic sand"; it occurs as spherules, ranging in size between No. 8 and No. 10 shot. It has accumulated as in-shore dunes, some of which are from ten to twelve feet deep, but the average depth is probably about half as great. Dr. A. Rothpletz has advocated the theory [1] that these oolitic spherules are due to the agency of algæ living in the marginal parts of the lake. He asserts that the oolitic granules form the home of colonies of certain plants known to elaborate calcium carbonate, among which are Glœocapsa and Glœothecæ; and he advances the belief that marine deposits of similar kind are the products of lime-secreting schizophytes. I find little to support this theory. The spherules generally consist of siliceous nuclei coated with the calcareous material in concentric bands. The fact that the oolitic sand is found only near shore is in keeping with the view that the rounded form may be due to rolling.

A somewhat unusual phenomenon, seemingly dependent on the globular form of the oolitic particles, was observed by the writer recently.[2] From the eastern slope of Antelope island there was visible what appeared to be a segment of a brilliant rainbow of double width. It was plain, however, that no rain was falling in that direction. The position of sun and clouds was such as would produce the rainbow had rain been falling at the time. A wind blowing from the island toward the mainland had lifted the oolitic sand from the dry flats. The coloured band appeared to touch the lake bed, and its ends subtended with the observer an angle of about 40°. The rainbow colours were distinct and in the same order as in the ordinary bow. A fainter secondary bow was visible in the natural position, and with colours reversed as to order. It would appear that the spherical surfaces of the "sand" granules reflected the light in such manner as to produce the "sand-bow." Is it not possible that each spherule was surrounded by an atmosphere of rarefied air due to the heating effect of the sun, and that the passage of the light

[1] *Botanisches Centralblatt*, 1892, p. 35.

[2] See "A Sand-Bow," by the writer, *Science*, vol. xiii. N.S. p. 992.

rays from the denser atmosphere into the rarer envelope, and the reverse produced refraction of the rays as in the case of water-drops?

Economic Considerations.

The value of the lake water as a source of useful products was recognised by the early settlers of the region, and the harvesting of common salt from the brine dates from the first year of civilised occupation within the valley. Yet until less than twenty years ago Salt Lake salt was in bad repute, and the commodity was imported into this the richest salt region on earth. The objectionable quality was due to impurities, and this was a result of ignorance or lack of care in the preparation. The primitive mode of manufacture consisted in impounding shallow portions of the lake by dykes, and in allowing the imprisoned brine to evaporate to dryness under solar heat. Obviously, the sulphates as well as the magnesium compounds would thus be retained in the salt, and the product was an efflorescent mixture. The next step toward improvement consisted in the removal of the crystallised salt from the mother-liquor by draining; this effected but partial purification.

At the present time several large works are devoted to the manufacture of salt on the lake shores, and the product ranks among the purest varieties of commercial salt. The process now followed consists in pumping the brine into elevated conduits by which it is conveyed into prepared inland ponds, in the first of which (the settling ponds) it deposits its suspended matters, and from which it is run into the crystallising ponds. Here it is allowed to evaporate until salt deposits plentifully; and at the proper stage the mother-liquor, carrying most of the objectionable compounds, is drained away. The layer of salt at the close of the season averages six inches in depth, yielding about 900 tons to the acre. The salt harvest begins in autumn and continues into the winter months. The salt is gathered into hand-cars run on movable rails, and is piled in symmetrical heaps where it rests until required for shipment as coarse salt or for refining into the better grades of dairy and table salt.

The ponds now owned by the largest company operating cover 1400 acres, and the possible yield of a single season is about one and a quarter million tons. Lack of demand has prevented the utilisation of all the pond area every season, but an annual harvest of 150,000 tons by this company alone is common. According to the company's official statement, the coarse salt loaded on the cars for shipment is sold profitably at one dollar per ton, and the refined salt is marketed at the lowest current prices. The refining process consists in crushing, drying, and winnowing while hot. By the operation last named, the efflorescent salts, notably the sodium sulphate, are effectively removed. The quality of the product may be learned from the following tables, which present the results of the writer's analyses on samples procured by purchase in the retail market:—

After the Salt Harvest: Inland Crystal Salt Company's Ponds on southern shore of the Great Salt Lake.

	Refined salt made by the Inland Salt Co. 1889.	Table salt Inland Salt Company.	Coarse salt Jeremy Salt Company.	Table salt Jeremy Salt Company.
Sodium chloride,	98·407%	98·121%	98·101%	98·300%
Calcium chloride,	·371	·311	·322	·345
Calcium sulphate,	·650	·422	·364	·680
Magnesium sulphate,	·030	·022	·021	·042
Moisture,	·442	·911	·952	·158
Insoluble matters,	·102	·201	·214	·472
Loss and error,	...	·012	·026	·003
	100·002	100·000	100·000	100·000

Next to common salt, sodium sulphate suggests itself as a profitable product of the lake water. As already stated, this substance (commercially known as Glauber Salt, mineralogically as Mirabilite) separates from the brine at a certain low temperature. This critical temperature has been placed at about 20° F.,[1] but in the writer's opinion, based on careful observation, the separation begins at a higher point, probably within a few degrees of the freezing point of fresh water.[2]

As the crystallisation of the Mirabilite proceeds the water becomes opalescent; and the substance deposits over the lake bed and is cast up by the waves in such quantities as to cover the shore parts to a depth of inches or feet. The writer has waded through such deposits during the winter months sinking at every step to the knees. As the Mirabilite is speedily taken into solution when the water touches the critical point of temperature in the ascending scale, it must be removed beyond reach of the waves if it is to be preserved. A few years ago there was a temporary demand for the material, and it was easily gathered by the use of horse-drags. The purity of the substance as it occurs is shown by the following average results of analyses by the writer. Chemically-pure Mirabilite consists of anhydrous sodium sulphate 44·1 per cent., water 55·9 per cent.

Analyses of Mirabilite collected from winter deposits on the shores of the Great Salt Lake.

	1. East shore deposit.	2. West shore deposit.
Sodium sulphate,	43·060	42·325
Sodium chloride,	·699	·631
Calcium sulphate,	·437	·267
Magnesium sulphate,	·025	·018
Water,	55·070	55·760
Insoluble matters,	·700	·756
Loss and error,	·009	·243
	100·000	100·000

The easy preparation of sodium carbonate from the Mirabilite is self-suggestive, and experience has demonstrated the success of the undertaking at low cost. The first stage of the Le Blanc process of the

[1] *Lake Bonneville*, p. 253.

[2] *The Great Salt Lake Present and Past*, pp. 84, 85.

carbonate manufacture —that of preparing the sulphate from the chloride —is here performed by nature on an immeasurable scale; and the limestone and coal necessary to the transformation of the sulphate into carbonate are of ready access. A factory for the preparation of sodium carbonate, hydrate, hyposulphite, and other compounds, was successfully operated until the enterprise was killed by the high cost of railway transportation. The industry of chemical manufacture from the briny lake awaits only a market for the products.

In connection with the economic importance of the lake, the deposits of guano on some of the islands may be mentioned. This material has accumulated as a result of the annual nesting of innumerable gulls and pelicans on some of the smaller islands, and the deposits are worked for the valuable fertilisers they afford. Hat or Egg island is the principal rookery.

Life in the Lake.

In accordance with a popular fallacy the statement is often made that no living thing tenants the Salt Lake brine, and the lake is frequently referred to as the "Dead Sea of America." True, the species of plants and animals known to inhabit the lake are few: but of these some exist in great numbers. Of the animals native to the brine the writer has confirmed the presence of the following:—*Artemia fertilis*, Verril, otherwise known as *Artemia salina*, in all stages from the egg to the mature form; (2) the larva of one of the Tipula flies, probably *Chironomus oceanicus*, Packard; (3) a species of Corixa, probably *Corixa decolor*, Uhler; (4) larvæ and pupæ of a dipterous fly, *Ephydra gracilis*, Packard.

The larvæ of Ephydra and of the Tipula fly may be found in numbers amongst the algæ near shore during the warm season; and the pupa cases of these species at times line the shore and emit by their decomposition an unbearable stench.

The most abundant species is the tiny crustacean known as the Brine Shrimp (*Artemia*). These seldom exceed a third of an inch in length, but their diminutive size is compensated by their numbers. Between May and October they may be found near the surface over the whole lake area; as the cold season approaches they confine themselves to the warm shore shallows as long as the water is calm; but rough weather at any season drives them into the deeper parts. During the summer the shrimps gather in such numbers as to tint the water over wide areas; indeed, while cruising upon the lake at this season I have repeatedly taken a pint or more by means of a small tow-net within a few minutes. The swarming numbers in which the brine shrimps occur are due to their prolific nature, and to the absence of enemies.

I have captured the shrimps in the open lake in midwinter, when the temperature of the brine was far below the freezing point of fresh water. They possess marvellous powers of adapting themselves to rapid changes of density in the water. I have taken them from the settling ponds at the salt works, when the brine was almost saturated, and by gradual dilution have accustomed them to a medium of fifty per cent.

fresh water. Among the shrimps the females greatly predominate at all seasons, and during the winter months a male is rarely found.[1]

It is generally known to zoologists that *Artemia* affords one of the most striking examples of parthenogenesis or reproduction by means of unfertilised eggs. Siebold of Munich has affirmed that with *Artemia* and certain allied entomostracans the parthenogenetic mode of reproduction is common. The Salt Lake shrimps are prolific egg-producers, and the

Artemia fertilis (brine Shrimp, male).

creatures may be bred through several generations though males be persistently excluded. The observations of Schwankewitsch on the brine shrimp at the salt works of Odessa indicated remarkable changes of form resulting from progressive dilution or concentration of the medium. Thus, with an increase of density from 8 to 25 Baume through a period of

[1] For further notes concerning the brine shrimp of the lake, its habits, methods of mounting for microscopical examination, etc., see the following by the writer: *Journal, Royal Microscopical Society*, 1901, pp. 557, 558; "The Brine Shrimp of the Great Salt Lake," *American Monthly Microscopical Journal*, vol. xiii., 1892, pp. 284, 285; *The Great Salt Lake, Present and Past*, pp. 67-76.

three years *Artemia salina* assumed the form of *Artemia muehlausenii*, till that time supposed to be a distinct species. An experiment reversing the conditions was conducted, and within a few weeks a change towards the normal form of *Artemia salina* was apparent. Then by further dilution he bred from the *Artemia salina* the form known as *Branchinecta shæfferi*, and later other forms.[1]

The lake flora has received but little attention at the hands of investigators. That algæ exist in considerable variety is attested by the shore accumulations of many colours and forms. Living diatoms are common in the brackish water near river mouths, and diatomaceous deposits are found in the older lake beds.[2]

Pleasure Resorts on the Lake.

The fame of the Great Salt Lake as a bathing resort has long been widespread; and now thousands of tourists with other thousands of Utah residents gather at this natural sanatorium every year. The remarkably high density of the brine gives a buoyancy unknown to the sea-bather. It is physically impossible for the human body to remain submerged, and the swimmer has but to lie at ease and float rather upon than in the water. Nevertheless care and skill are necessary, and the untrained swimmer had better not venture beyond wading depth. The danger lies in the certainty of partial or complete strangulation if the irritating brine enter mouth or nostrils.

Among the well-equipped bathing pavilions the most important are Saltair and Garfield. Saltair pavilion, the more pretentious of the two, was built in 1893 at a cost of over a quarter million dollars. When first constructed it was nearly a mile from shore, the railway leading on a pile-supported track into the lake. This island-like situation gave greater depth for bathing, and moreover secured immunity from insect pests and shore stench incident to the accumulation of pupa-cases at the water margin. The recent recession of the lake has advanced the shore line to within a hundred feet of the shallow-water wings of the pavilion. The buildings are supported on 2500 piles each ten inches in cross section and driven fourteen feet into the lake bottom. In the work of pile-driving an unexpected difficulty was encountered. The lake bottom at this place consists of a top layer of "oolitic sand" loose or but slightly compacted to a depth of eight to ten inches. Then follow two feet of the "sand" well cemented by calcareous material, and then seven or eight feet of compact Mirabilite or sodium sulphate. It was found impossible to penetrate this layer of "soda" by the ordinary method of pile-driving; indeed even with steel-shod piles but little was accomplished. The following simple and efficient procedure was adopted. Steam under moderate pressure was conducted through pipes to the "soda" at the point where a pile was to be driven. The sulphate dissolved at once

[1] Prof. J. S. Kingsley, *Riverside Natural History*, vol. ii. pp. 40, 41.

[2] For an interesting description of land insects inhabiting the shores of the lake see "Insect Fauna of the Great Salt Lake," by E. A. Schwarz, in the *Canadian Entomologist*, vol. xxiii., 1891.

Garfield Beach Pavilion, as seen from the lake ; old sea-cliffs in the background.

and the post was set with a stability beyond expectation. One of the officials in charge stated in a personal note to myself, "After the piling has been allowed to set for twenty-four hours, it is impossible to drive it even a quarter of an inch, though you might hammer the piling until you wore it down."

The Mirabilite bed was encountered in the driving of posts at Garfield pavilion, and the deposit is known to occur inland to a considerable distance, though buried beneath several feet of "oolitic sand."

The buildings at Saltair extend 1115 feet in length, with a greatest breadth of 335 feet. An auditorium on the upper floor covering 140×250 feet is domed by a roof without a supporting pillar between the walls. This is constructed after the plan of the justly famed "Mormon" tabernacle at Salt Lake City.

SIR JOHN MURRAY'S SCHEME FOR THE INVESTIGATION OF THE NATURAL HISTORY OF THE FORTH VALLEY.

By Marion Newbigin, D.Sc.

(*Read before Section E of the British Association, September* 1901.)

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It has been suggested that a brief account of the above scheme might prove of interest to the members of the section, and that further, the occasion presented an opportunity for discussion likely to prove of value to those interested in the carrying out of the work. As the whole scheme is still in embryo, it should be understood that the following paper does not in any sense deal with the results of research, but is merely a tentative account of the aims and plans of the Scottish Natural History Society.

First as to the genesis of the scheme:—The Scottish Natural History Society has its headquarters in Edinburgh, and has some two hundred and thirty ordinary fellows. A not inconsiderable proportion of these have made the study of some branch of natural history their life-work, but the majority, as in most similar societies, are able only to devote their spare time and energy to scientific pursuits. Hitherto the work of the society has consisted chiefly in evening meetings held during the winter months, where subjects of a more or less general nature have been discussed, and in excursions to places of interest during the summer. Work of a more serious nature has been carried on, to a greater or less extent, in the small sections connected with the main body. Sir John Murray, in the course of a presidential address to the society, commented on its size and opportunities, and suggested that it might be made to yield more tangible results from the scientific point of view, by a more judicious use of these opportunities, and by taking fuller advantage of

the principle of co-operation. Ultimately, he generously offered to place the sum of £100 at the disposal of the society, to enable the members to keep a systematic record of observations made, or information acquired, relating to the natural history of the Forth valley. The object of the donor, so far as it was grasped by the members, is that the society should accumulate in a readily accessible form, information relative to the Forth valley, whether due to the research of members or others, so that this information may be at once available to any one desirous of knowing what has been done in regard to any particular point. Further, as the area is one which is undergoing constant change, it is desired that the facts obtained should be sufficiently detailed in nature to form a record of environmental changes. At the same time, it is eminently desirable that the work should be so conducted, that one justification of the existence of the society should be clearly kept in view—that is, its value as a training-school in the aims and methods of scientific research. This is of special importance in an educational centre like Edinburgh ; and it is no small part of the function of the society to stimulate and attract the large number of educated people who are within reach. There is indeed no doubt that both the field and the labourers are waiting; the only difficulty lies in the question how the material may be best utilised.

As to the range of the investigation, it has been thought best, in the first instance, that we should confine ourselves to the Forth valley, an area which includes a great variety of physical conditions, and is of great interest alike to geologist, zoologist, and botanist. It is indeed in many ways peculiarly suited for a detailed survey of the kind which we propose to make, containing as it does mountain tracts and plain tracts, inland and maritime tracts, under conditions likely to make a detailed study of distribution one of great interest. The Forth valley district has been taken as defined in Mr. Harvie-Brown's Naturalists' Map of Scotland, and it is intended that maps of this area should be supplied to members. As thus defined, the area forms the dividing line between the Highlands and Lowlands, including parts of both districts, though its Highland flora is poor. The eastern region is chiefly maritime, and except where the boundary line touches the watersheds of the Pentlands, Moorfoots, Lammermuirs, and Ochils, consists of the low or undulating ground in the vicinity of the estuary. The western region is inland, and is divided by a line drawn between Callander and Aberfoyle into a Highland and a Lowland portion, of which the latter consists chiefly of Old Red Sandstone and the former of metamorphic rocks, the two being separated by the great fault. The eastern region is of course chiefly composed of carboniferous rocks. This brief description may serve to recall the geographical interest of the area and the variety of the conditions included in it. The area has always been of great interest to the historian, because of the conflict of races which has taken place in it. This conflict has been largely determined by the geological configuration of the land, and there is no doubt that it has been paralleled among more lowly organisms. To the seeing eye there are probably in it many more battle-fields than those marked with a cross on our maps, and we hope

that our investigations may enable us to decipher some traces of the strife which ensued when the western flora and fauna encountered the eastern, the maritime the inland.

Another suggested preliminary to the work, in addition to the obtaining of suitable maps, is that the portion of *Field's Catalogue* referring to the area in question should be purchased, and that members should gradually complete this by obtaining references to the papers which appeared prior to the beginning of this *Catalogue*. The question as to the best method of recording the facts obtained by the members is one which is still under discussion, but the consideration of this may be postponed until the society's plans have been outlined. As it is proposed to utilise the existing sections of the society in the work, it may be convenient to consider the general scheme under the headings of the different sections.

Botanical Section.—In a society of this kind, botany is a subject which must always attract many adherents, and arouse much interest. Not only is it more easily studied than zoology or geology, but in its rudiments the science is familiar to most, and its relation to gardening and agriculture gives it a special interest. As further an acquaintance with the common British flowering plants is readily acquired, the members of the section are hopeful of producing good work, and of being able to utilise the co-operative principle to its fullest extent. Since the area has been fully surveyed, the construction of a flora in the ordinary sense forms no part of their plan. Further, as it is one of the objects of the society to promote the love of nature, and also a respect for it in all its forms, the search for rarities or the encouragement of the vulgar mania for collecting, finds no place in the general scheme. Indeed, one of the difficulties which the botanists have not yet solved, is what is to be done with records of rare plants, and how the latter are to be preserved from the hands of those not sufficiently civilised to be trusted with them. It is, as I think, no small part of the work of the society to show by its example a more excellent way to the ardent but circumscribed enthusiast, whose idea of botanical study is to root up any rare plant he sees with the object of planting it in his own back-garden.

The section intends to devote its time chiefly to the common plants of the area, studying these from their modern aspect, in their relation to problems of distribution, of variation, and so on. In their work they have been much stimulated by the late Mr. Robert Smith's paper, entitled, *A Botanical Survey of the Edinburgh District*, which, with its accompanying map, is a model of what such an investigation should be. Among the detailed suggestions for work which they have drawn up, the following may be mentioned: The detailed study of circumscribed areas in the immediate vicinity of Edinburgh, such as Arthur's Seat, Duddingston, Blackford Hill, and so on. These separate areas are assigned to members of the section, who record their plants, and visit them periodically, noting the prominence of different plants at different times, the variations of species, times of flowering, and so on. This is a division of the work which obviously permits of great extension, and which should be very readily carried out. In a large society like the present, there are many

members whose homes are on the outskirts of the town, and who could readily adopt a geographically circumscribed area as their special hunting-ground, and note the annual and seasonal variations of its inhabitants. As many of these localities are undergoing constant change, records kept from year to year should not fail to be of interest. Detailed observation would also shed much light on the respective efficacy of the different methods of distribution, under given conditions, and also on some of the debated questions connected with self and cross fertilisation. Where, as in many spots close to towns, certain species are gradually being exterminated, it would be of great interest to discover whether this is chiefly due to physical conditions, as alteration in the composition of the soil or in the amount of moisture, or how far it is affected by the extermination of insects useful in fertilisation, or by increased difficulties in distribution. Darwin's proof of the connection between cats and clover has been quoted for many years as the stock instance of correlation between organisms, and yet there is much reason to believe that any waste patch of ground would yield many fresh instances.

Another question to which the botanical section proposes to devote attention is the time of flowering of different plants in different localities. This is a question which might perhaps be most profitably studied in connection with meteorology, but even in themselves a careful series of records in regard to dates of flowering for certain selected localities should prove of great value. In domestication it is a familiar fact that the strength and fertility of the offspring depends much upon the time of year at which they are produced. Late-hatched chicks, it is said, never thrive well, and it is quite possible that, especially in the case of plants with a short reproductive period, the time of flowering has much influence on the fertility and the chance of survival. Another piece of work which the section proposes to undertake, and one which might legitimately form the object of a series of excursions, is the investigation of the flora of a river valley from source to mouth. In a much owned and cultivated country like Scotland such a piece of work is often impossible for private individuals, while an influential society might find no particular difficulty. The Almond and the Esk have been suggested as rivers whose flora it would be easy to study in this way. The special object would be to study the range of particular species, and the changes which the flora undergoes in the passage from mountain to valley and plain tract. The Forth area, as already indicated, includes mountain conditions as well as maritime ones, and might afford opportunities for the study of the relation of the mountain flora to the littoral one. Thus it is a familiar fact that certain common shore-plants, such as sea-plantain (*Plantago maritima*), sea-campion (*Silene maritima*), sea-pink (*Armeria maritima*), scurvy-grass (*Cochlearia maritima*), reappear on the tops of high mountains, but are absent from intervening areas; this peculiarity of distribution being determined by the fact that the plants are xerophytes, and can only thrive under certain conditions. A study of a river valley might show the relation between these sharply separated groups of individuals, and help to define more accurately the meaning of xerophytism. Other points which may be taken up by members of the section are the varia-

tions in colour of flowers and their relation, if any, to the surroundings, while the aid of the photographer may be invoked to preserve views of characteristic patches of vegetation, masses of flowering plants, and so on. The work of the botanical section will also be greatly facilitated by the opportunities which the society offers of co-operation with the geologist and the entomologist.

In regard to the zoological side of the scheme, there seems to be a general consensus of opinion among the specialists, that no direct effort should be made to draw up or extend faunal lists. In the majority of groups this is rendered unnecessary by the existence of authoritative works, and where, as in the case of small or difficult groups, there is still room for further research, it is felt that any research which may be undertaken by individual members should be published by the individuals through the ordinary channels. If the society were to accept unpublished records, it would obviously leave open a door through which many errors might arise, especially in the case of difficult and obscure species. Further, the society has no wish to enter into competition with individuals or groups of individuals who may have been engaged for years in the study of some particular group. There remains the study of habits, of distribution, of surroundings, and especially of the relation between organism and surroundings, both organic and inorganic. A few suggested lines of work may be briefly mentioned. The society includes among its members not a few who are keenly interested in birds, and who in some cases at least have exceptional opportunities for systematic observation, and also the patient sympathy which makes fruitful observation possible. The society has not infrequently profited in its meetings from the work of such members, but it is a matter of common experience that the knowledge accumulated in this way may be lost, or never made fully available to those desirous of obtaining it. Its possessors often do not realise its value, or the necessity of making a permanent record; or the records themselves may be lost or dissipated. It is the desire of the society to induce such members to record their facts as they are obtained. For example, the percentage of nestlings successfully reared in the broods of common birds, the relative numbers of the birds which come to be fed from year to year in winter, the relative numbers of deaths from cold or exposure, the diet of common birds, are points in many cases easily observed and readily recorded. Many of our members are also very favourably situated for the study of migration, a subject in regard to which facts are always welcome.

Another subject which has aroused considerable interest among our members is the fauna of the ponds in the vicinity of Edinburgh. As our area includes, in Loch Leven and Loch Katrine, lakes of considerable size, the study of lacustrine faunas is included in the scheme, but meantime members seem content to work out the small pieces of water in the immediate vicinity of the town. The seasonal changes in these, the means of distribution of their inhabitants, the variations in the individuals, the methods of protection against drought, are all worth careful study. In the study of pond life the botanist and zoologist would naturally work hand in hand.

Among its members the society includes several enthusiastic entomologists, whose co-operation in the scheme it is hoped can be enlisted. Such points as the relative abundance of common species in a given locality, the causes of that variation in the abundance of individuals which is so common a phenomenon in the case of some familiar species, the existence of insect associations, the natural enemies of common species, and so on, might all form suitable subjects for observation and record.

Another subject of much interest is the distribution of marine animals in the Forth and its estuary. The tide is said to go up to Craigforth Mill, some three miles above Stirling, but the conditions cease to be maritime far below this. It would be of interest to trace the relation of fresh-water and marine species, both of plants and animals, from the mouth of the Firth upwards to Stirling. The Firth itself is muddy over at least a great part of its area, a fact which probably in part explains why the fauna off Dunbar and the May is richer than that farther up. Further, owing to the draining of the peat bogs in the drainage area, or to some other cause, it would appear to be growing muddier year by year. This must be leading to a gradual modification of the fauna, the extinction of species capable of thriving in clear water only, and the multiplication of mud-loving species. Some of the characteristic Firth of Forth varieties are no doubt due to the great beds of mud present everywhere, and a careful record kept over a number of years could not fail to shed much light on the origin of varieties, and the relation between organism and environment. For example, while the common whelk (*Buccinum undatum*) is usually said to inhabit only deep water, we have in the Firth a littoral variety very abundant in mud between tide marks. That this variety is increasing with the increase in the deposits of mud, is not only probable on general grounds, but is confirmed by its enormous fertility, and by the high percentage of hatching eggs to be found on all muddy parts of the shore, as, for example, at Joppa. In this, as in many branches of the suggested work, the aid of the photographer might be usefully invoked. Photographs of mussel beds, of typical low-water scenes, of the beach after storms, and so on, would all be of great value.

Geological Section.—The work of this section has always aroused much interest among the members of the society, and is capable of almost indefinite extension. The photographing of interesting surface features, examples of denudation, and so on, has always formed a considerable part of their work, and the systematic arrangement and classification of these should be a matter of no great difficulty. In many instances probably photographs which have been fully annotated will form the best record which can be drawn up by the geologist, but these can be supplemented by descriptions of interesting phenomena. The co-operation between geologist, botanist, and zoologist, should simplify many problems of distribution.

In the preceding pages some details have been given of the work which the different sections of the society propose to undertake; in conclusion something may be said of its general aspect. To sum up in the first place the preceding account, we may say that what the society

proposes to do is first to arrange in a readily available form the references to the papers already published on the natural history of the Forth valley, so that any one interested in the subject can at once lay hands on the work already done in regard to any particular point. This, which may be described as merely the mechanical side of the scheme, is greatly facilitated by the existence of *Field's Catalogue*, to which the society proposes to subscribe. The earlier references not included in this *Catalogue*, it is proposed to acquire gradually through the efforts of members. The purpose of this part of the society's work may be said to be merely to form a convenient index to the literature stored up in the various libraries of the city, for the formation of a new library is no part of its purpose.

Secondly, the society proposes to utilise its various sections, and the labours of its individual members, in the acquisition of a mass of detail in regard to the existing organic conditions in the Forth valley. In its most concise form the object of this endeavour may be stated to be to form a basis of fact upon which general conclusions may be later established, though its function as a means of training will also not be lost sight of. It is hoped that the work may be carried out in such a way that any person desirous of finding out what is known, say in regard to the conditions of existence of the common limpet in the Firth of Forth, may on reference to the society's records, readily learn not only what papers have been written on the subject, but may also find clear and definite statements as to the range, size, and so on, within the area. In thus definitely limiting the scope of the work, we have been guided by the criticisms, favourable and unfavourable, which have been made during the discussions held in the society, or have reached us from the outside during the preliminary period of probation. Most of those who have thought at all of the scheme, seem to see clearly certain dangers which beset it; the danger, for example, of premature and ill-advised publication, of converting the society into a collecting organisation, and of checking the progress of science by encouraging error. We do not propose to collect or to found a museum, nor to accept among our records new statements or novel conclusions which have not already been published through some one of the ordinary channels. It may be said that there is a possibility of error even in such a simple statement as that the bulbous buttercup grows on Blackford Hill, but the risk is obviously much less than in one such as that a new species of fly was found there; and as the facts which we hope to accumulate are those which in themselves have little significance, and are only of value in relation to the great body of facts, errors should be of little moment, and should be comparatively easily detected. It must not be supposed that this resolution of the society to stand aloof in its official position from general conclusions, is influenced by that profound modern scepticism which leads some scientists to confine their attention to details as the only truths. It is rather due to a conviction which seems widely spread among the members, that scientific work of that kind must be due to the activity of individuals, and that only the humbler accumulation of details can profitably be undertaken by a co-operative body. The question whether

individual members of the society might periodically edit portions of the society's records for publication, or discuss the general significance of certain of them, is one which it may be convenient to leave to the future to decide.

A technical question which the society has not as yet fully decided is the exact method in which the records are to be stored. Some modification of the card catalogue system is suggested, but the exact details and the methods of arrangement are not as yet determined. Many forms of records might conveniently be made on maps, which would be the clearest way of recording distribution. As literature references are to be kept on Field's cards, for convenience of storage it is thought best in the majority of instances to use the same or similar cards for other records. The extent to which the system of cross references should be carried out is another still debated point. For example, a useful piece of work would be to compare the animals found between tide marks at certain points of the Firth, say at North Berwick, Joppa, and at some point farther up. The results might be tabulated under the headings of fauna of the special localities, or under the species named in a systematic catalogue, or under both. Some of these difficulties will no doubt solve themselves when work is fairly begun. In other cases it is probable that among such a large number of members, some will be found willing to devote much attention to clerical work, and to construct a system of cross references from cards furnished by other members. It has been suggested that references to a particular species should not only give the author to whom the species is due, but also a reference to a readily available book in which a good description and figure of the species are given. To secure uniformity of nomenclature the section concerned will in most cases determine the author whose names are to be accepted. Where individual members signify their intention of studying one particular species or genus, they will be furnished with index cards giving references and chief synonyms, and a series of blank cards on which they may inscribe the new facts observed. Before insertion in the cabinet these cards would be revised by the section, and cross references, or duplicates if necessary, written out.

In conclusion, it may be well to state definitely that the society has not embarked upon this scheme in order to justify its existence as a society. We consider that to promote an interest in scientific pursuits among those not scientists by profession, and to help to spread existing scientific knowledge, is in itself an end worthy of attainment. At the same time we feel that as an organised body we possess more energy than is being employed in doing useful work, and that this energy might be utilised to lighten the labours of some future naturalist, who possesses the power of generalisation, and that we might thus, though in a subordinate capacity, truly assist in the progress of knowledge. As a society we wish only to be the handmaid of science, to perform the drudgery necessary before any step in advance can be taken. It is our hope that the scheme, carried out along the lines indicated above, may enable us to do this.

NOTES ON THE BRITISH ASSOCIATION MEETING AT GLASGOW, 1901.

UNDER the able presidency of Dr. H. R. Mill, Section E (Geography) met on four days during the meetings of the British Association, and listened to twenty-seven papers and reports, in addition to the President's address. Not a few papers of geographical interest were also read before other sections, and on Monday, September 16th, the section met in conference with Sections C and D to discuss "The Objects and Methods of the Scientific Study of the Lakes of the British Islands," with special reference to the scheme of survey to be carried out by Sir John Murray and Mr. Laurence Pullar.

Dr. Mill's address was printed *in extenso* in the October number of *The Geographical Journal*, but its salient features may be here briefly indicated. The subject was "Research in Geographical Science," and the author defined geography as "the science which deals with the forms of relief of the earth's crust, and with the influence which these forms exercise on the distribution of all other phenomena," a definition which was elaborated in detail in the earlier part of the address. In classifying the branches of geography, the author recognised mathematical geography as the first and basal division. This merges into physical geography, including geomorphology, oceanography, and climatology, while the geographical distribution of life falls into bio-geography, from which anthropo-geography is sufficiently important to be considered distinct. As divisions of anthropo-geography again must be recognised political geography and commercial geography. From this outline of the scope of geography, the author passed to a consideration of the nature and kind of research requiring to be done to construct a complete geographical description of even the British Islands. He spoke of the survey of British lakes, and of various other detailed survey still requiring to be done, such as the survey of the superficial soil as it affects agriculture, and of methods of synthesis by means of which all the geographical knowledge acquired could be combined and condensed for each unit of area. While recognising that a survey of the British area on the scale thus indicated can hardly be hoped for as yet, the author noted the efforts being put forward in various directions to carry out portions of the work. He pointed out that the dangers of the inadequate recognition of geography as a science have been abundantly exemplified in South Africa, in Venezuela, in Alaska, and elsewhere, and that the kind of research which is most urgently needed cannot be hoped for until the subject of geography is more adequately endowed in Britain than at present.

It may be convenient to note the other papers read before the section according to the nature of the subject discussed rather than in strict chronological order. Historical Geography was represented by a paper by Mr. E. G. Ravenstein, on the old (1459-1507) geographer, Martin Behaim, of Nürnberg, whose claims to fame are said to rest on

three grounds: (1) that he was a pupil of Regiomontanus; (2) that he was a member of Cao's second expedition (1485-86); and (3) that he constructed the first geographical globe, which is still in existence at Nürnberg. In regard to the last fact no doubt exists, but the other two statements are probably erroneous. It would appear probable, however, that Behaim took part in José Visinho's expedition to the Guinea coast in 1484, and also in d'Aveiro's voyage to Benin, which occurred in the same years as Cao's second expedition. Mr. Ravenstein exhibited drawings and photographs of Behaim's globe, and proposes to shortly publish a facsimile of it.

Among the very numerous papers on general Physical Geography, the following may be mentioned: Dr. A. J. Herbertson exhibited a morphological map of Europe, and described the different natural regions into which the continent may be divided, and Mr. H. Yule Oldham gave an interesting description of an experimental demonstration of the curvature of the earth's surface, which was carried out on a six-mile stretch of the New Bedford river, the locality of Dr. A. R. Wallace's experiment in 1870. Mr. Ravenstein presented the final report of the Committee on the "Climate of Tropical Africa." The general conclusion arrived at by the committee is that no single district can be regarded as thoroughly healthy from the point of view of the European, for even where the mean temperature is moderate, this is due to the fact that the days are hot and the nights cold, while at many of the stations the humidity of the atmosphere is a great drawback. In connection with this subject of African climate, mention may be made of Major Ronald Ross's paper on Malaria, read before Section D. From the geographical point of view, perhaps the most interesting point is the measure of success which has already rewarded the efforts made to diminish the number of mosquitoes in *e.g.* Sierra Leone, by diminishing the pools of stagnant water in which these insects breed, and the proof that malaria can be altogether escaped by Europeans exercising proper precautions.

An interesting paper by Mr. H. N. Dickson dealt with "The Mean Temperature of the Atmosphere and the Causes of Glacial Periods." Starting with the assumption that secular variations of climate in the past have been due to changes in the mean temperature of the atmosphere, the author pointed out that such changes have probably been associated with large relative alterations in the gradient of temperature between the Equator and the Poles. But as this difference of temperature is the primary cause of the whole planetary circulation of the atmosphere, the form and intensity of the latter must have varied with it. Thus a lowering of the mean temperature would be accompanied by an increase of the Equator-Poleward gradient, a rise by a diminution of it, and in the former case the planetary circulation would become more active, and the tropical high pressure belts would be displaced to lower latitudes. It is suggested that the effect of these changes on the distribution of precipitation, and on the position and direction of the great cyclone tracks, may explain some peculiar features of glacial phenomena.

Other papers on the atmosphere were those by Messrs. Shaw and Rotch. Mr. W. N. Shaw spoke on weather-maps, and the necessity for

synchronous observations in the different parts of the world, a necessity as yet practically recognised only in Canada, the United States, and Mexico. In Europe the different countries have not adopted a common time for their observations. Mr. A. L. Rotch spoke of a method of exploring the atmosphere at sea by means of kites, which could be carried on even in calms with the assistance of steamers.

Dr. Vaughan Cornish read the report of the committee appointed to investigate "Terrestrial Surface Waves," the report including an account of Dr. Cornish's expedition to Canada to study the surface forms of snow. Some very striking photographs of snow-forms were obtained, and a series of observations made on snow-waves and ripples, which differ in several respects from the homologous æolian sand-ripples.

In connection with the remarks made by Dr. Mill in his presidential address in regard to the desirability of studying surface soil, it is interesting to note that Mr. J. R. Kilhoe read a paper on "Geology regarded in its Economic Application to Agriculture by means of Soil Maps" before Section C, in which he dealt with the means by which geological knowledge could best be applied to agriculture, and made readily available to farmers and others, and also described a method of constructing maps to show the main features of the soil in different areas.

In regard to the geography of special districts, Dr. Robert Bell read a paper on the geography and resources of Northern Ontario, and the Report of the Committee on the "Survey of British Protectorates" was read, which contained the following recommendations. First, that the advantages of a common scale should be impressed on local administrations who have already commenced surveys; second, that the attention of local administrators should be drawn to the necessity for adopting a geodetic base in order to test the accuracy of their linear measurements, for without this accuracy of the initial base measurements it is impossible that the various separate surveys can be made to fit into one homogeneous map: third, the Committee emphasise the necessity for co-operation between different workers in connection with mapping, and especially between the Intelligence Department and the Royal Geographical Society; finally, they lay great stress upon the necessity for making use of trained native assistants in regard to topography. This has been done to a very large extent in India, and it is very necessary that it should also be done in Africa.

Several papers were devoted to the regional survey of parts of the Scottish area. Mr. G. F. Scott Elliot spoke on "The Effects of Vegetation in the Valley and Plains of the Clyde," showing by a series of lantern slides how largely the characteristic appearances presented at different parts of the Clyde valley depend upon the nature of the vegetation. The formation of holmlands or flats was proved to depend chiefly on the work of certain marsh plants, especially *Scirpus lacustris*, *Phragmites*, *Vaucheria*, *Poa fluitans*, and various sedges. The author also proved that the nature of the vegetation controls the slope formation of the sides of the valley throughout, the successive stages in slope formation being traced in several instances in the river Clyde and its tributaries. Prof. W. G. Smith gave an account of the "Botanical Survey of Scotland"

begun by his brother, the late Mr. Robert Smith, and now being carried on by himself. Prof. Smith, among other points, alluded to the difficulty of mapping cultivated land, and especially in distinguishing between land on which wheat can and can not be grown, for the distinction is not absolute, but fluctuates to some extent from economic causes. Miss Newbigin read a paper on the "Investigation of the Natural History of the Forth Valley," which appears in this journal. Two other papers bearing also on Scottish geography were read before sections F and H. One by Dr. J. F. Sutherland dealt with "The Growth and Geographical Distribution of Lunacy in Scotland," and showed that the ratio in the Highlands was greatest, 93 per cent. greater than that for the Midland counties, where it is least, 70 per cent. greater than for the Southern region, and 60 per cent. greater than for the North-Eastern. Dr. Sutherland considers that the high Highland ratio cannot be assigned to any one cause, though no doubt the migration of the strong and healthy to the industrial centres has considerable influence. A less obvious cause is the high rate of infant mortality in the crowded areas—it is nearly four times greater in the Midlands than in the Highlands—this removes at an early age children who, in the Highlands, might live to swell the ranks of the insane. The other paper, which was by Messrs. Tocher and Gray on "The Frequency and Pigmentation Value of Surnames of School-Children in East Aberdeenshire," contained some points of considerable interest as regards the races of Scotland. Thus, surnames common among fishing communities had a high pigmentation value, which the authors believe confirms the common view that the fishing population of the East of Scotland is of Belgian origin, the Belgians being the darkest people of Northern Europe. The pigmentation of Highland surnames corresponded closely with the pigmentation in their districts of origin. Thus the blonde Frasers originate in the blonde Inverness district, the dark Robertsons in dark Perthshire, and so on.

At the conference on the scheme put forward by Sir John Murray and Mr. Laurence Pullar, for the investigation of lakes, the purpose of the investigation was put before the meeting, and various members of the Geographical, Geological, and Zoological sections spoke in support of the scheme.

Several papers on Travels and Explorations were read before the section. Dr. F. Moreno exhibited a series of fine slides relating to the ethnology of certain parts of the Argentine Republic, and Mr. Hesketh Prichard described his travels in the same region. A paper on the scientific results of the Belgian Congo Expedition by Captain Lemaire was read on behalf of the author by Staff Commander Dubois Phillips, and illustrated by lantern slides and water-colour drawings. The plans and organisation of the National Antarctic Expedition were described by Dr. J. S. Keltie, and Dr. Mill gave an account of the voyage out to Madeira. Mr. W. S. Bruce spoke of the Scottish Antarctic Expedition, which is to start next year. In Section D the report of the Committee on the Expedition to the Malay States contained many notes on the Natural History and Ethnography of the Malay Peninsula. Dr. Logan Jack read a paper before Section E on Travels in China, which

gave some account of the Chengtu plain and the rivers which fall into it from the north. Portions of the courses of the Ya-lung and Yangtse near Kwa-pit and Li-kiang respectively, were also mapped with more definiteness than had hitherto been attained. The journey made was from Shanghai to Ichang and on to Chengtu, thence after crossing the Mekong and Salwen rivers to Bhamo in Upper Burma. A paper by Mr. Archibald Little on navigation in the Yangtse was read by Mrs. Little, and one on Itineraries in Portuguese Congo by the Rev. T. Lewis.

Two important papers on Political and Commercial Geography were read, one by Mr. G. G. Chisholm on "Geographical Conditions affecting British Trade," and the other by Prof. Alleyne Ireland on "The Influence of Geographical Environment on Political Evolution." Mr. Chisholm pointed out that Britain has commercially a great advantage in regard only to those parts of the world conveniently reached from the seaboard, and therefore all improvements in connection with shipping have increased her advantage, while all improvements in reference to the means of communication between inland centres of production and inland markets have relatively diminished her trade advantage. The industrial advantage of Britain depends on the abundance of iron and coal in convenient situations, and tend to diminish with the development of the coal and iron fields of other countries, *e.g.* of Germany and the United States. Again, in recent years there has been a great development of the means of utilising water-power, which tends to the advantage of such countries as Switzerland, Norway, etc., more than to Britain. The case of Italy is specially interesting, for she is now beginning to utilise water-power largely, and from her situation is eminently well-fitted for the development of a great carrying-trade. In the interesting discussion which followed, Mr. Atkinson of Boston, U.S.A., foreshadowed the effects on the commerce of the world of the adoption by America of Free-Trade principles. Prof. Ireland's thesis, briefly stated, was that experience proves that the natives of tropical and sub-tropical countries are incapable of being trusted with governing powers, and that therefore representative institutions are not suited for tropical countries. In all such countries he believes that the duties of administration must rest in the hands of specially trained Europeans. Unfortunately, no opportunity for discussion presented itself at the close of this paper.

This report will show that many of the papers read before Section E were of considerable scientific value, and by their diversity should tend to improve the position held by geography in this country by showing the wide range of subjects included in the science.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

A Meeting of Council was held on 21st November, when the undermentioned ladies and gentlemen were elected Members of the Society :—

The Lady Dowager Clark.	Thomas G. Clark.
Miss Park.	David Crombie.
Mrs. Park.	Councillor Thomas Geddes.
Miss Rhoda Pullar.	Hugh Grant.
James A. Aikman.	George Halley.
Andrew Balfour, M.D., C.M.	Wm. G. C. Johnston.
Henry Blyth.	Peter Macnaughton, S.S.C.
Robert M. Clark, B.Sc.	William Tod.

Miss M. I. Newbigin, D.Sc., was appointed Editor of the Society's *Magazine* in room of Mr. George Sandeman who has resigned that appointment.

The Annual Business Meeting

was held on the same day, in the Society's Hall. Dr. John Kerr, who was in the chair, regretted the absence of the President, Sir John Murray, who was unavoidably prevented from attending the meeting. He said that the Annual Report of the Council would be submitted to the meeting, and that the annual elections to the Council would be proceeded with. He made special reference to the appointment of Miss Newbigin as Editor of the *Magazine*.

Sir John Murray, K.C.B., was then re-elected President, and the Vice-Presidents were also re-elected. The following Members of Council, who retire by rotation, were re-elected :—Sir James A. Russell, Dr. George Smith, C.I.E., W. B. Blaikie, Dr. D. F. Lowe, Dr. J. W. M'Crindle, General Dalmahoy, Dr. John Kerr, Colonel Cadell, V.C., and Andrew Coats. Rev. Dr. Ewen, *Glasgow*; G. W. Baxter, LL.D., *Dundee*; and James Spence, *Aberdeen*.

The following members of the Society were elected to the Council to fill vacancies :—Viscount Dalrymple, John Geddie, Sheriff Guthrie, K.C., Wm. B. Wilson, W.S., Rev. Dr. James Stewart, Kenneth Sanderson, W.S. Robert Fullerton, M.D., *Glasgow*, and Rev. Colin Campbell, D.D. *Dundee*.

Paul Rottenburg, LL.D., was appointed Chairman of the Glasgow Branch, in room of Sir John Neilson Cuthbertson who has resigned that office. The honorary and the salaried officials were re-elected.

The Report of Council, which is printed at the end of this number of the *Magazine*, was adopted.

Meeting held in November.

The Rev. Adrian Hofmeyer addressed the Society as follows on *Lake Ngami and the surrounding Countries*:—At Edinburgh on 18th November, Professor S. H. Butcher in the Chair; at Dundee on 19th November, G. W. Baxter, LL.D., in the Chair; and on 14th November at Aberdeen, where the Chair was taken by Mr. John Clarke. The lecture session at Glasgow was opened on 25th November by an address from Professor George Adam Smith, D.D., entitled *A Recent Expedition East of the Jordan, with the Discovery of some Inscriptions.* The Chair was taken by Dr Paul Rottenburg.

GEOGRAPHICAL NOTES.

EUROPE.

Bathymetric Observations on the Coast of Gerona.—G. Pruvot, in describing (*Archives d. Zoologie Expérimentale*, ix., 1901) a dredging cruise in the yacht *Roland*, gives a sketch-map of the Spanish coast from Cape Creuse to the mouth of the river Tordera, showing the depths obtained by a series of soundings. The point of interest is that while the coast is fringed throughout the greater part of its area by a continental plateau, or *planassa*, with a slope of about 3 per 1000, the 150-metre line being distant some 18 kilometres from the shore, at two places this almost horizontal plain is cleft by two narrow and deep ravines, giving depths of 1123 and 1095 metres respectively, at a distance of 12½ kilometres from the coast-line. For these ravines the author adopts the Spanish name of *rech*. In both cases the landward extremity appeared to be bounded by sharp rocks on which the dredges caught. To the northern, which is off Cape St. Sebastian, the name Rech of St. Sebastian is given, to the southern Rech of Blanes, from the village to which it is adjacent. Though at first the continental plateau appeared to be at the same depth all along the coast, close examination showed that it is slightly oblique to the north, a sounding off Cape Negro giving 110 metres at a distance from the shore at which at Palamos the depth is only 90 metres. Further, so far south as the Cape of Tossa, the littoral deposits consist of mud; this littoral mud blending gradually with the oceanic mud. South of this line, the littoral deposits become sandy, the beginning of the sandy area corresponding to the elevation of the plateau, and to the mouth of the river Tordera. Similar littoral deposits of sand occur outside the area in the vicinity of the rivers Besos and Hobregat, and as the three are the only rivers which traverse the granite axis of Catalonia, it seems a fair deduction that the change in the deposits is due to the nature of the material brought down respectively by the Ter and Tordera (the former traversing only alluvial plains before reaching the sea), and the change in depth to the more voluminous deposits of sand. This explains the want of perfect horizontality in the plateau, and leads the author to consider it probable that the whole plateau owes its origin to terrigenous deposits, and that the ravines are due to the presence on the sea bottom of certain very prominent rocks, which have, as it were, sheltered the areas concerned from the deposits. As the distribution of marine organisms off the coast depends on the nature of the littoral deposits, and therefore differs in the sandy and muddy parts of the area, the author concludes that the zoogeographer must depend upon the geologist to answer many problems connected with the distribution of marine animals.

Bulgaria.—Dr. Daneff, the Bulgarian Minister of Foreign Affairs, recently stated that discussions have lately taken place regarding the advisability of opening a line of navigation between Varna, Burghas, and the French ports. This would be most useful to Bulgaria for the exportation of grain. They are also anxious to further their commercial relations with Britain, which imports much Bulgarian produce, and exports manufactured articles to the Principality. The fine quality of the latter is recognised by all. German trade is also progressing, while that of Austria-Hungary is falling off.

Limits of the Gulf Stream in the Arctic Ocean.—This question has been made the subject of numerous researches ; and still the position of the Gulf Stream, between the coasts of Norway, Siberia, and Nova Zembla remains obscure. Prince Galitsini has tried to solve this question, and has published the results of his observations on board the *Samoyède* on a voyage between Archangel and the island of Karmakoul, situated on the west coast of Nova Zembla.

In the Arctic Ocean the Gulf Stream is easily distinguished by its blue colour, its strong salinity, and its high temperature. According to Petterson it undergoes variations in its intensity, which appear to be in connection with certain climatic conditions, and notably with the existence of the warm and cold winds of Northern Europe.

After doubling North Cape the course of the Gulf Stream is across the Arctic Ocean, towards the coast of Nova Zembla. The northern limit of the belt which it forms has not been as yet precisely determined ; as to its southern limit, its course is east-south-east, parallel to the Murman coast, which it follows for 50 or 60 miles. Towards long. 40° E. and lat. 69° 30′ N. this southern limit of the Gulf Stream takes a distinctly eastern course, passing near the island of Kolgouyev, and touching Nova Zembla towards Goose Cape. The distance of the current from the Murman coast is more or less great according to the season. South winds drive it 100 miles to the north ; while, under other conditions, it is very near the coast, and, according to some observers, enters Murman Bay. Sometimes it is encountered near the entrance to the harbour of Iekaterinski.

On a level with the island of Kolgouyev, to the right where the Gulf Stream changes its direction to reach Goose Cape, it sends towards the east a branch which loses itself among the fresh waters coming from the Petchora. It is also to be met with near the island of Vaigatch. Opinions are divided as to the direction of the principal branch, which flows along the coast of Nova Zembla. According to one it immediately washes the shore ; according to others it turns aside for 50 or 60 miles. It is doubtless true that in some years the current enters Moller Bay, and helps to make the climate of the west coast of Nova Zembla mild. There is good reason for supposing that some cold currents from the Straits of Kara have the effect of driving the Gulf Stream to the west. The variable degrees of salinity and temperature show that there are mixtures of waters of different origin.

The existence of detached branches of the Gulf Stream in the neighbourhood of Cape Kanin and Cape Sacré is still a matter of controversy. Some years a branch goes round the first of these promontories, but is soon lost as it enters the White Sea. The existence of the current in the neighbourhood of Sviatoï Nos is equally probable.

The Russian-Swedish Expedition has returned from Spitzbergen. But, whilst the Russian section, under the leadership of Tschernyschew, the geologist, were successful in finishing their work, and were able to fix the degrees of longitude and

latitude, the Swedish section, under Professor de Geer, only reached their field of labour after great difficulty and delay, and did not succeed in fixing the northern triangles on the Seven Islands. They will therefore—if the Reichstag supplies the necessary means—return to Spitzbergen next year in order to fill up the lacuna in the map.

ASIA.

India.—The opening of the Jehlam Canal took place at Rasal on October 29. It has been built in two years, and has cost 125 lakhs. It will irrigate 612,000 acres of land, yielding annual crops worth £1,220,000. The progress of irrigation in the Punjab during the last thirty-six years has been great. In 1864 canals irrigated 625,000 acres, the net profit being 12 lakhs. Last year 6,000,000 acres were irrigated, and the profit was 108 lakhs.

The New Anglo-Indian Trade-Route.—Lord Ronaldshay, who has lately travelled over the new trade-route between Quetta and Meshed, has communicated to *The Times* some interesting information regarding his journey. This new route was opened a few years ago by the Indian Government, in order to facilitate trade between India and Persia. Previously all merchandise despatched from British India had to be shipped from Bombay or Karachi to Bunder Abbass, whence it was conveyed by mule or camel caravans throughout Persia. Now shipping is entirely avoided, and all goods are carried on mules or camels from Quetta to Sistan, and from there sent to various parts of Persia. Considerable advances have in consequence taken place in trade, and should progress continue, the construction of a railway may take place in the near future. From Nushki to Sistan the route is perfectly level, and very suitable for camel and mule transport. It is a well-known fact that Russia has for years been pushing her trade through Persia towards the southern seas. British trade in Persia has in consequence suffered much; in the north it is practically dead, and the south would soon have suffered to a similar extent had this new route not been opened. Lord Ronaldshay states that the farther north he went, the more apparent did Russian influence become. Beyond Berjand, to which one Indian merchant has penetrated, all the goods sold are Russian. The Persians, while appreciating the quality of British and Anglo-Indian goods, purchase more or less Russian goods because of their cheapness. The Trans-Caspian railway facilitates Russian trade with Persia, and by its means merchandise is transported at a cheap rate. Lord Ronaldshay, who took careful observations of the country, says that the engineering difficulties of a railway from Quetta to Meshed would be practically *nil*. The route between Quetta and the Persian frontier is dead level, with the exception of a steep descent from the Quetta plateau to Wushki.

Railway Project between Asia and America.—Mr. Harry de Windt, the explorer, will start on December 10 from Paris, on a journey across Asia and America. He has twice before essayed to accomplish this journey, but failed. The first time he was captured by Koari, the chief Tchuktchi; and the second time (in 1900), on account of the political situation in China, he was refused permission to cross Siberia. Now, however, he has obtained the permission of Russian and American authorities, and also the consent of Commandant Melville, the chief of the Washington Naval Department.

Mr. George Harding, who is to accompany Mr. de Windt on this expedition, will set out from Paris about the beginning of next month for Yakutsk, where he will collect the dogs and reindeer, and await the arrival of de Windt.

Starting from Paris on December 10, de Windt will travel by the Trans-Siberian railway as far as its terminus at Irkutsk, where he will arrive about December 20. From here he will go direct to Yakutsk, a distance of 1300 miles —a sledge journey which will take about three weeks. He will rest for a fortnight at Yakutsk, and along with Mr. G. Harding, will set out about the third week of January in a NE. direction, traversing an uninhabited and practically unknown country as far as Nijni-Kolymsk—the most remote district in the north-east of Siberia, upon the coast of the Arctic Ocean. Between Yakutsk and Nijni-Kolymsk (a distance of 1500 miles) the transport will be by reindeer. This part of the journey, and also the crossing of the Verkhoyansk Mountains, will be very difficult. They hope to arrive in Nijni-Kolymsk in February, and here the explorers hope to find the caravan of a fur and ivory merchant *en route* for one of the little colonies upon the coast of the Behring Straits. The journey being about 1500 miles from Nijni-Kolymsk, they do not expect to reach the coast before the middle of April. Then they will cross the ice as far as Cape Prince of Wales, the most westerly point of America, the distance across the Straits being about the same as from Dover to Calais. Should the condition of the ice not prove favourable, the Naval Department at Washington have arranged for the *Bear* to take Mr. de Windt across. From here he will return by the Yukon and Mackenzie rivers to Winnipeg, San Francisco, and New York, which he hopes to reach next June.

The principal object of the expedition is to take observations of the country to the north-east of Yakutsk, the point from which the Russian Government propose to construct a railway next year, after which Yakutsk will be the junction of the Manchurian and Siberian railways. The country from Yakutsk to the Behring Straits, with the exception of one range of mountains, is perfectly level; and this part of the journey will also be measured, in view of an extension of the railway upon the American coast; the surveyors have already commenced to work at the extension of the Klondyke railway, as far as the American side of the Behring Straits. Although the latter are comparatively narrow, the terrible currents and the ice exclude the possibility of constructing a bridge to connect the two continents; but there are Belgian and American engineers who think that it would be possible to make a tunnel. Twenty-five fathoms is the greatest depth of the Straits at any part. The project is interesting: we always have our doubts about the possibility of crossing the Straits by the ice with dry feet. It does not appear, according to the relations of most travellers, that there is ever total congelation. Owing to the strong currents, the central part of the Straits remains unfrozen, although obstructed by floating ice: and on account of this it is almost hopeless to expect to cross from the Eurasiatic to the American continent, in spite of their proximity, without navigation. Mr. de Windt's journey will therefore be watched with great interest.

From Kratie to Nha-Trang across the Province of Dar-Lac is the title of an interesting article in *La Géographie*, by the late Duc Henri d'Orleans. Wishing to study in Annam certain colonial questions, the Duc d'Orleans sought a different route from that which he had traversed along the coast in 1895. At Saignon he became acquainted with M. Bourgois, the French Government Commissioner at Dar-Lac, who proposed that they should travel together as far as Kratie. The plateau, which extends between the north of Cochin-China, the provinces of Kratie, Stung-Treng, Attopeu, Phon-Yen, and Khan-Hoa, was formed into a province dependent on Laos in 1899, with the name of Dar-Lac. In spite of the splendid work performed by the Pavian Mission, certain parts of the Indo-Chinese Empire are still com-

paratively little known. Such is the condition of the region which extends from Kratie to Nha-Trang. It is hoped that within the next few years the map—which is still almost a blank—will be filled in.

On April 29 the travellers set out on their expedition. The baggage was carried by elephants and in carts drawn by oxen. During the first few days the journey was through a very flat country, across a monotonous forest glade; the temperature varying during the day from 98° to 120°. After having crossed the river Krieng, Srekie was reached on May 2. Srekie is a little village consisting of a few cottages, in the neighbourhood of which rice is cultivated. The inhabitants belong to the Penang Kroll, a scarce tribe, who have a dialect of their own.

The western frontier—the delimitation of which is still imperfect—of the Dar-Lac province was reached on May 5. Camping upon the banks of the Thioba, a tributary of the Se-Bang-Kan, the travellers came upon another Kroll village, This region seems to be very fertile and suitable for cultivation. Still traversing the same flat glades and forests, and after fording many rivers, Ban-Don was reached on May 15. Some good sport was to be had while waiting for a few hours for the possibility of crossing the Olle-Cagn, the waters of which had been considerably swelled by a rain during the night. Ban-Don is on the right bank of the Se-Bang-Kan. The village is composed of houses with thatched roofs raised on piles. The same construction is to be found among the Muongs and on the Indian frontiers. The inhabitants belong to the Khas Radais tribe, a tribe who were met with constantly during the remainder of the journey.

Quitting Ban-Don next day, the route lay to Ban-Metute, the actual seat of the Commissariat, which was reached in two days. The road lay through immense forests, in which are trees of the greatest beauty; through glades, where one still sees the roots of the trees which have been burnt that the soil may be used for the cultivation of rice. Villages are very numerous, and comfort and peace seem to reign amongst them.

At Ban-Metute a pretty house has been built for the Commissioner. In this district the soil is rich and vegetation is plentiful. The altitude is about 400 metres, and the average temperature during the day is 98°. Here M. Bourgois took leave of the expedition, important business affairs requiring his immediate attention.

On May 21 a start was again made. During a part of the journey the route was across a very fertile region. The next day from a little hill on the right bank of the Se-Bang-Kan the first glimpse of Dar-Lac was obtained; on the farther side of the plain could be seen the lake, called Tet-Lac, from which the province takes its name. This lake seems to be about two or three kilometres in dimension. It is so much indented that it is difficult to give any exact idea of its shape. Its greatest depth is supposed to be about two or three metres; its banks, which are covered with long grass, abound with water-fowls; pheasants are also abundant. The plain is dotted with villages built of bamboo, and inhabited by a very indolent tribe. The lake is gradually diminishing in extent, and rice-fields now cover the land from which the water has receded. This lake was discovered by M. Bourgois two or three years ago. On May 23 the road lay across a country where vegetation was very abundant. Ban-Heung, on the Se-Bang-Kan, was reached the following day, and there the travellers were very cordially received. Mesao was reached on May 25, and from there an entry was made into Annam. The route followed and the country traversed are well known.

Leaving Ban-Merung on May 25 and crossing a beautiful plateau which seemed highly favourable for cultivation, Ban-Metute was reached on May 28.

The country abounds with buffaloes, oxen, and deer. After two days' march by great rivers, and over high hills, the travellers gained the little town of Nink-Hoa; and on May 31 the residence at Nha-Trang. The journey over 592 kilometres had taken twenty-two days (after deducting resting days).

The province of Dar-Lac, from the account given by the Duc d'Orleans, seems to have great possibilities before it in the near future. The ground which is still unexplored is most probably rich in minerals: the soil is fertile; and forests of beautiful trees abound. Objections have been made to the construction of a railway, but it is hoped that in a few years the difficulties will be overcome, and this extensive country brought into direct communication with the commercial world.

The Peking-Han-Kau Railway.—The progress in the construction of the Lu-Han Railway, as the line projected to connect Peking with Han-Kau is called, is rapid. It is expected that Hsin-yang, 346 miles from Han-Kau, will be reached by rail early next year. Some of the stations on the line are in course of construction, and Han-Kau central station is nearing completion.

AFRICA.

Fauna of Madagascar.—Franz Poche points out that among the many peculiarities of this fauna is the fact that it shows a relation to that of Southern America. Thus, the cat-fish genus *Auchenipterus* has (fresh-water) representatives in both regions, and this is true also of the goby *Cotylopus*, which is found in America, in Reunion, and in Madagascar, but nowhere else. Similar conditions exist in regard to the snake genera *Boa* and *Corallus*, which occur only in South America and the region of Madagascar.—*Zool. Anzeiger*, xxiv., 1901.

British African Expedition.—This expedition, which for the past ten months has been engaged in surveying along the Anglo-Abyssinian frontier, has now reached home, and full details of the great sufferings experienced by its members have been published. The expedition under the command of Major Austin, R.E., which left Omdurman in December last with orders to survey the Anglo-Abyssinian frontier, took an escort of twenty men of the 10th Soudanese Battalion, under Mabruk Effendi, together with transport-drivers and personal servants, numbering in all 59. The transport-animals included 15 camels, 12 mules, and 125 donkeys.

From Omdurman to Nasser Fort the journey was made in a gunboat. Disembarking, the expedition proceeded south along the Pibor river, to its junction with the Akobo at lat. 7°47′. After crossing numerous swamps, the unknown country of Boma, referred to in Captain Welby's book, was entered. Here the natives are very shy, and gave the travellers a wide berth. In March last a great desert was entered, where great sufferings and privations were endured for a month. The animals were often 48 hours without water. The men also suffered much during this journey across the desert, and became very listless. There is, however, no truth in the rumours current at Cairo of a mutiny.

The Sacchi river, to the west of the Omo, was reached about the beginning of April, and here plenty of water was found. Large herds of elephants and giraffes were met during the whole of the period, but there was little opportunity for sport. Four days after leaving Sacchi, Major Austin concluded his survey from the north, having joined up with his former survey from the Mombasa side. By this time provisions were short, and the position was critical, all being reduced to less than half rations. The transport animals had to be killed for food, and for ten weeks donkey and mule flesh was the only meat available. Finding it impossible to proceed farther in this plight, the expedition decided to strike south into the

Uganda Protectorate, the main survey between the Soudan and Abyssinia being completed. Heavy rains having now set in, the whole appearance of the country was so altered by shallow lakes of rain-water, that Major Austin, who had been over this section of the road in 1896, was unable to follow his old route. Lake Rudolph was not reached until May. It was then hoped the difficulties were over, but worse was still in store. The hardships and privations were telling upon all. Major Austin became seriously ill with an attack of gastritis, which occasioned a delay of some days. The night before Lake Rudolph was reached, a band of Tarkhana attacked some members of the expedition and murdered three soldiers. At midnight they tried to rush the camp, but were finally beaten off. They followed the expedition for several days, keeping up a rear and flank attack, in which several of Major Austin's men lost their lives. During this time the Soudanese, although starving, displayed great gallantry. The Turkhana are described as a race of very fine physique, mostly over six feet in height. They are quite naked, and their hair, which hangs to their waist, is arranged as a kind of bag, and made to hold various trinkets and personal ornaments. It took fully a month to get clear of their country, during which time thirty members of the expedition died of exhaustion.

A move was next made in the direction of Lake Baringo, which was reached in July; and the expedition, all in a state bordering on collapse, spent some time at the British post there, and received great kindness from Mr. Hyde Baker. Only fourteen men were now alive out of the fifty-nine that had started. After a few days' rest Major Austin and his companions proceeded to Nakuro, where they joined the Uganda railway *en route* for Mombasa.

Railways in Southern Rhodesia.—The High Commissioner for South Africa sends the following particulars relating to the railways at present being constructed in Southern Rhodesia:—(1) A line, 3 feet 6 inch gauge, from Bulawayo through Gwelo to the Globe and Phœnix Mine—150 miles long; (2) a line, 3 feet 6 inch gauge, from Salisbury to the Globe and Phœnix Mine—150 miles long; (3) a line, 2 feet gauge, from Salisbury to the Ayrshire Gold Mine, Lomagondi district—78 miles long; (4) a line, 3 feet 6 inch gauge, from Bulawayo to the Gwanda district, Matabeleland—120 miles long; (5) a line, 3 feet 6 inch gauge, from Bulawayo in the direction of the Waukies Coalfield and Victoria Falls—160 miles long. It is stated by the Administrator of Rhodesia that it is intended to extend the last of these lines through the Waukies Coalfield to the Victoria Falls and across the Zambezi, but the survey being not yet completed, no contract for the extension has been given.

Dr. Kandt's Expedition in Ruanda.—*La Géographie* states that Dr. Kandt has again explored the larger tributaries of the Kagera, the most important affluent of Lake Victoria. Starting from Kivu, he gained the junction of the Akenyaru and the Niavarongo. As it was the dry season the papyrus marshes presented no difficulty; and a comparison was again made of the volume and current of the two rivers. Dr. Kandt again states that the Niavarongo is the greater and more rapid, and should therefore be considered the chief tributary of the Kagera.

Dr. Kandt afterwards explored the course of the Kagera, which he had not before seen, and which is not indicated on the Ramsay map. He then penetrated into the province of Buguesera. On account of nearly five years' drought, lacustrine basins which Ramsay and he had before encountered had considerably diminished or else entirely disappeared. Returning along the banks of the Akenyaru, Dr. Kandt followed this valley, which is large and well cultivated. About twenty kilometres south of the junction of this river with the Kagera, he discovered

the western extremity of a lake, which is fed by the Akenyaru. Dr. Kandt thinks he could identify this lake with that indicated on the Stanley map under the name of Lake Alexandra. The Akenyaru changes in appearance very much as it flows south.

On leaving this river, Dr. Kandt proceeded to Isavi, in the centre of the province of Ganamukari, the most densely populated region he knows in Africa. After visiting the section of the Akenyaru, which he had not yet explored, Dr. Kandt followed the upper course of the Kagera Nile, from its junction with the Ruvuvu to its source.

The Journey from Mombasa to Khartum has been accomplished by Mr. H. C. Kuehlewindt in ten months. Starting from Cairo *viâ* Aden, he proceeded from Mombasa through British East Africa as far as the rail terminus, from whence he set out, fully equipped with the necessary appliances for geologic research, accompanied by 200 Uganda porters, and an escort of 50 Suaheli Askaris. After travelling for about 120 miles Kisumo on Lake Victoria was reached. From there he crossed in a Government steamer to Entebbe, the capital of Uganda. Then a move was made into the practically unknown region of Lake Rudolph, to the sources of the Sobat river, from whence, in consequence of the scarcity of water and the animosity of the well-armed native tribes, they turned back in a westerly direction, until they reached the Nile at Gondokoro. Here Mr. Kuehlewindt dismissed his followers, and came down to Khartum in the Government steamer. During his expedition he has explored some districts hitherto unvisited by any white man; and in one of these districts, north of Satuka, he came upon an interesting tribe, governed by a black queen named Daweng, by whom he was most hospitably received, although they had never before seen a white man.

Exploration of the South of Madagascar.—M. Guillaume Grandidier sends good reports of the work he has accomplished in the unknown south of Madagascar. From Fort Dauphin he took with him 30 Singalese and 120 Malgaches porters. Since he set out he has visited Tsiombe on the Manambovo, passed by Behara and Ambovombe. Here the country is not so dry as was expected, and is densely populated. Vakiandro, king of Karimboly, furnished M. Grandidier with a guide and water-bearers, as to the east of Tsiombe there is a four days' march over a waterless desert. Leaving Tsiombe on July 15 the expedition travelled by way of Faux Cape and Cape Saint Marie to the mouth of the Menarandra, near which is the little port of Ampalaza, discovered by the Dutch in 1595. Continuing his journey towards the north, always traversing new country, he arrived about the beginning of August at Tulear. This region is composed of a vast level plateau, covered with a thorny, impenetrable brushwood, and is densely inhabited. At several places the dearth of water was very much felt. The voyage has been rough and dangerous, and would have been impossible had M. Grandidier not had the able and willing assistance of General Gallieni and Colonel Lyautey. The whole of the country explored has been carefully mapped at 1 : 200,000. From Tulear, in the course of August, he went by land to Lake Tsimanampetsotsa and has succeeded in mapping this region also. The country here is very interesting, but, judging from reports, is very poor; water is scarce, and is briny; the inhabitants are very miserable; and with the exception of sheep and some birds there are no animals.

Returning by Tulear, which he left on August 25, he will go north as far as Mangoka to make palæontologic excavations at certain points along the coast. After which he will return to Fort Dauphin, again crossing the southern region but by another route, passing by Sakamare and Tsivory.

Arguin and Portendick. M. R. de la Vaissière in a recent number of *Questions Diplomatiques et Coloniales* gives an interesting description of Arguin and Portendick. Arguin Bay measures seven miles from east to west, and is seven miles long. Formerly numerous frigates used to anchor in the harbours of Senegal: now a vast sandbank obstructs the entrance, and makes its access dangerous even to boats of small tonnage. It would be imprudent for ships drawing more than fourteen feet of water to venture into this gulf, which is full of sandhills from thirty to thirty-six feet high, resembling those to the north of the Spanish coast of Rio de Oro. In this bay is situated the island of Arguin, which was discovered in 1443 by the Portuguese. Here they constructed a very strongly fortified magazine, and for a long period were exceedingly prosperous. They penetrated the mainland as far as Adrar, and had an important trade-centre at Nadan. In 1638 the island was captured by the Dutch, in 1665 by the English, and the following year retaken by the Dutch. It was captured by the French in 1678. Later, a trading company, said to be Portuguese, made Arguin the centre of their operations for the gum trade; ships from all countries were admitted into the bay on payment of a fixed sum. Owing to this free traffic, the country became an important commercial centre. It was retaken by the French in 1724, and since that time has remained in their possession.

The country surrounding the Bay of Arguin is inhabited by the Imraghen, a tribe of the Uled-Busba, and descendants of the great Morocco stock who emigrated in the *Erguibat* and the *Tekna*. These natives are mostly engaged in fishing.

The island of Arguin, which is about five miles long and over two miles broad, is composed of a plateau of sandstone descending in a sharp point towards the south. Scattered throughout its whole expanse are hills covered with shell debris. Its soil is in general covered with fine sand; and vegetation is poor. The climate of Arguin is salubrious, because of the fine breezes which blow from April to July. The temperature is always supportable, but the months most favourable to Europeans are October to December. The true importance of Arguin consists in its fishing industry, and especially cod-fishing. In the fourteenth and fifteenth centuries these fisheries were frequented by Basques and Portuguese, but the difficulties of navigation caused them to be abandoned, and to-day they are not fished except by the Islenos of the Canaries. The fish here obtained are quite as good as those got farther north.

Portendick has suffered in a like manner to Arguin. After a struggle for supremacy between the English, Dutch, and French for almost a century, the latter were ultimately successful, and since 1727 have been supreme in Portendick. Like Arguin it has suffered the same vicissitudes of trade, and is no longer a commercial centre.

It would be possible to restore the commercial activity of these islands by establishing anew the gum trade. If the natives of the western Sahara were to find there a lucrative sale for this natural product they would naturally increase their acacia-verek plantations, and in this way augment the production of gum. The needs of modern industry are such that the European markets could easily dispose of ten times more than they do at present.

Railway Construction in Nyassaland.—Contracts for the construction of a railway between Chiromo and Blantyre, with provisions for an extension to Lake Nyassa, have just been concluded between the Imperial Government and a company registered under the title of the Shiré Highlands Railway, Nyassaland (Limited). The railway to be constructed is on the 3 ft. 6 in. gauge with a single line, and is to lie wholly within the Protectorate. It is stated that the actual con-

struction of the railway will commence within fifteen months. This line of railway between Chiromo and Blantyre will connect the centres of the coffee industry with sea by way of the rivers Shiré and Zambesi, and will also benefit the chief industries of the country by releasing, for labour in the plantations, the natives who have hitherto been engaged in transport work: and when the Lake Nyassa extension is built, a valuable trade-route of nearly 1200 miles in length will have been established through the heart of the lake country.

AMERICA.

The Corundum Mines of Canada.—The American Consul-General at Montreal has issued an interesting report on the corundum deposits in Ontario. Corundum is becoming an article of great value in industry on account of its high abrasive power. It is superseding emery as a grinding material, emery being only an inferior and impure quality of corundum. The latter, on account of its rarity and cost of mining, has until recently been little used. But the Ontario deposits are of such value and so easily worked, that in future it will be supplied at a more reasonable price. Corundum is a compound of aluminium, and of the same material as the ruby and the sapphire, but has not their brilliance. The deposits in Ontario lie to the north of Kingston, and cover a large area. They are rich in the mineral, easily worked, and so situated that transport will be cheap. It was hoped the ruby and sapphire would also be found here, but as yet this has not been the case.

GENERAL.

The Baldwin Expedition to Franz Josef Land, and from there northwards, has begun under favourable aspects. The provision-ship *Fridtjof* returned to Tromsö on August 30, after having been from July 27 to August 24 in Franz Josef Land. She landed the provisions and dogs, along with six additional people, near Cape Höfer in Wilczek Land. The *Fridtjof* did not meet the *America*, on which Baldwin himself was, until August 18. When the *Fridtjof* began its return journey the *America* was beginning to push on towards the most northern accessible point, where provisions were to be landed and the crew were to pass the winter. The *America* will then return to Cape Höfer for the dogs, but should the weather prove unfavourable, it is possible that they may not be able to again reach the main body of the expedition before spring.

On September 4, a few days after the arrival of the *Fridtjof*, the large Russian ice-breaker, the *Ermack*, arrived in Tromsö. Admiral Makarow had not been able on account of the ice-pack to fulfil his intention to go round Nova Zembla and then advance to the mouth of the Yenissei. Notwithstanding the splendid machinery and the great dimensions of the *Ermack*, the ice-blocks were too strong to be broken. This voyage has proved that even ice-breakers like the *Ermack* are not sufficient to break through to the North Pole, and it is hardly probable that any government or patrons of Polar expeditions will provide the necessary money to construct further ice-breakers according to the model of the *Ermack*.

German South Polar Expedition.—Dr. E. v. Drygalski gives an account of the progress of the expedition to the Cape Verd Islands, Porto Grande being reached in the evening of September 11th. The weather experienced was of a generally favourable type, and various scientific investigations had been carried on during the voyage. Numerous observations on the salinity of sea-water taken from various depths were made, also on the bacteria of the sea, and the gases present in sea-water. After landing at Porto Grande, where several days were spent,

numerous magnetic observations were made, and a pendulum experiment. Various collections were also obtained by members of the party, and Dr. Gazert made a series of anthropological measurements. The party expected to reach Cape Town on October 20th.—*Petermann's Mitteilungen*, xlvii., 1901, x.

Ordnance Survey of Scotland.—The following publications were issued from 1st to 31st October 1901 :—Parish Maps (Scale 1 : 2500, Revised, with Houses ruled, and with areas, Price 3s. each). *Aberdeenshire.*—Sheets XIX. 3, 4 ; XX. 1, 3 ; XXIV. 4, 8, 12, 16 ; XXV. 5, 6, 9, 11 ; XXXIII. 1, 9 ; XXXIV. 5 ; XLII. 7, 15 ; XLIII. 5, 9, 13 ; L. 14 ; LI. 3, 7, 8, 12 ; LXIX. 2, 8. *Banff.*—Sheets XXXVII. 8, 11, 12, 15, 16. *Forfarshire.*—Sheets XXIII. 13, 15 ; XXX. 2, 7, 13, 14 ; XXXVI. 3, 4 ; XLII. 12, 15, 16 ; XLIII. 5 ; XLVIII. 6, 7, 9, 10, 11, 14, 15, 16 ; LIII. 1. *Inverness-shire.*—Sheets XLVI. 2, 6, 14, 16 ; LIX. 1, 2, 5, 7 ; LX. 1, 2 ; LXXIII. 7, 8, 9, 10, 13, 14 ; LXXXVIII. 1. *Orkney.*—Sheet LXX. 11, 16 ; LXXI. 5, 9, 13 ; LXXII. 4, 8, 11, 12, 16 ; LXXV. 2, 3, 4 ; LXXVI. 1 ; LXXVIII. 11, 12, 14, 15, 16 ; LXXXII. 4. *Perthshire.*—Sheet XLIII. 14. Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

Four-Mile Maps of Scotland : by Sheets, with water printed in colour. Sheets 16, 17 ; Price 1s. each.

Four-Mile Maps of Scotland by Counties. Flat in Sheets or folded in cover, with roads and water printed in colours. Caithness and Sutherland, comprising Sheet 6 and parts of Sheets 3, 5, 8 ; Price 9d. Dumfriesshire, Kirkcudbrightshire, and Wigtownshire, comprising parts of Sheets 16, 17 ; Price 9d.

Six-inch Scale (Revised). *Inverness-shire.*—Sheets 121, 135, 148 (Engraved) ; Price 2s. 6d. each. Sheets 76, 91 (120 and 105), 134 (147 and 156), 157 (Engraved) ; Price 2s. each.

Six-inch Maps (Quarter Sheets—Revised). *Aberdeenshire.*—102 SW. (Price 1s.). *Perthshire.*—15 SW. ; 16 SE. ; 17 SW, 17 SE. ; 25 NE., 25 SE. ; 33 NW. ; 112 NE. (Price 1s. each). With contours : *Aberdeenshire.*—21 SW. ; 23 NW. ; 31 NW. ; 32 NW. ; 35 NE. ; 54 NW. ; 65 SW. ; 73 NE. ; 93 SW. *Perthshire.*—63 SW., 63 SE. ; 73 NE., 73 SE. ; 75 SW. ; 86 SW., 86 SE. ; 87 NW., 87 SW., 87 SE. ; 99 NW., 99 SW. ; 109 NE. ; 111 NW. ; 118 NE. ; 119 NW. ; 120A NW. ; 128 NW. ; 129 NE. (Price 1s. each).

Catalogue of the Ordnance Survey Publications of Scotland, revised and corrected to the 1st January 1901. This is the last edition issued.

Norwegian North Polar Expedition.—Preparations are being made for the despatch of a new Norwegian expedition to determine more exactly the position of the north magnetic pole. The expedition will be under the leadership of M. Amundsen, a Norwegian, who accompanied M. Gerlache's Antarctic expedition.

The Duke of Abruzzi's Expedition sent out to search for the three lost members of his Polar Expedition, has returned, after having explored the southern coast of France Josef Land, without finding any traces of the missing men. A memorial to the men was erected on Cape Flora.

No News of Captain Sverdrup and the *Fram* is brought back by the Peary relief ship *Erik*. At Disco Inspector Jansen reports that in March 1901 a steamer, which might have been the *Fram*, was seen far off the shore, in Davis Straits, and heading northwards. The failure of Peary's expedition to meet her or find any trace of her work in his Greenland coast journeys lends colour to the generally accepted belief that, having found a high northern latitude impracticable, she has attempted the Upper Jones Sound and the almost unknown lands and waters to the westward.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Seventeenth Session, 1900-1901.

The Council has the honour to submit the following Report :—

Address to the King.

On the occasion of the death of Her Majesty the Queen, a loyal and dutiful address was submitted, on behalf of the Society, to His Majesty the King, who was pleased to transmit a gracious reply thereto.

Patronage of the King.

His Majesty has also been pleased to grant his patronage to the Society.

Membership.

Changes in the number of members have occurred as follows :—

Number on 1st November 1900,		1546
New members added,		39
		1585
Deduct by Deaths,	28	
„ Resignations,	94	
Struck off the roll (subscriptions in arrear),	10	
		132
Number remaining on 31st October 1901,		1453

Of the present members, 852 are on the Edinburgh list, 261 are on the Glasgow list, and 105 and 84 are on the Dundee and Aberdeen lists respectively; in addition to these, 101 members reside in England and 50 reside abroad. Of the 1453 members, 250 are life members.

The Right Hon. the Earl of Galloway and Sir Thomas Clark, Bart., Vice-Presidents, died during the Session.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1900 to 31st October 1901.

FUNDS AT CLOSE OF LAST ACCOUNT :—			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,		496 2 0	
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,		301 9 10	
£200 Great Central Railway Company 4½ per cent. Debenture Stock, cost, 31st December 1898,		312 2 9	
		£2212 14 4	
BALANCE DUE BY BANK OF SCOTLAND :—			
On Current Account (Edinburgh),	£213 10 8		
Less applicable to Antarctic Exploration Fund,	49 4 0		
		164 6 8	
BALANCE due by Secretary, £5, 13s. 6d., and by Aberdeen Treasuer, £6, 5s. 2d.,		11 18 8	
		£2388 19 8	
ANTARCTIC EXPLORATION FUND :—			
Sum in Bank of Scotland, Edin., on Deposit Receipt,	£100 0 0		
Do. do. on Current Account, as above,	19 4 0		
		149 4 0	
		£2538 3 8	
SUBSCRIPTIONS from Ordinary Members.	£1232 14 0		
Do. do. Life Members,	31 10 0		
LECTURE TICKETS sold,	34 2 6		
MAGAZINES sold,	72 12 4		
DIVIDENDS and INTERESTS,	77 10 0		
		1448 8 10	
ANTARCTIC EXPLORATION FUND,		13 10 0	
		£4000 2 6	

MAGAZINE—Printing, Paper, Lithographing, etc., from Nos. 8 to 12 of Vol. XVI., and Nos. 1 to 9 of Vol. XVII., all inclusive, and for Postages, Delivery, etc.,		£769 1 2	
Less—Received during the year for Advertising,		51 18 10	
		£657 2 4	
GENERAL PRINTING,		19 4 7	
BOOKS and other Furnishings for Library,		15 17 8	
RENTS OF HALLS, and other expenses of Lectures,		208 11 4	
RENT OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,		123 11 9	
SALARIES :—			
To *Secretary*,	£200 0 0		
,, *Editor and Clerks*,	231 10 0		
		431 10 0	
MISCELLANEOUS, including Stationery, General Expenses, Advertising, Cleaning, Postages, and General Expenses at Glasgow Branch,		57 13 9	
MEDAL,		2 14 6	
		£1516 5 11	
FUNDS AT CLOSE OF THIS ACCOUNT :—			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost. 29th May 1885,	£1102 19 9		
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,	496 2 0		
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,	301 9 10		
£200 Great Central Railway Company 4½ per cent. Debenture Stock, cost, 31st December 1898,	312 2 9		
	£2212 14 4		
BALANCE due by Bank of Scotland, Edinburgh, on current account (Edin.), £158 4 7			
Less—Applicable to Antarctic Exploration Fund, 62 14 0			
	95 10 7		
Balance due by Secretary, £4, 18s. 9d.; by Aberdeen Treasurer, £4, 15s. 11d.; and Glasgow Treasurer, £3, 3s.,	12 17 8		
	£2321 2 7		
ANTARCTIC EXPLORATION FUND :—			
Sum in Bank of Scotland, Edinburgh, on Deposit Receipt, £100 0 0			
Sum in Bank of Scotland, Edinburgh, on Current Account, as above, 62 14 0			
	162 14 0		
		2483 16 7	
		£4000 2 6	

Alterations of Laws.

The following alterations were made in the Society's Laws, viz. :—

In Law No. XI., the words "the Chairman of the Society's Branches" were added after "the Trustees."

Law No. XVII. was altered, and now reads as follows :—"The property of the Society shall be vested in not fewer than three Trustees."

Finance.

The Council begs to submit the annexed Financial Statement.

Livingstone Medal.

A Gold Medal, to be called the "Livingstone Medal," and to be the special award of the Society for *Geographical Exploration and Research*, has been endowed by Mrs. A. L. Bruce, in memory of her father, Dr. David Livingstone.

Medals and Diplomas of Fellowship.

The Society's Medal and Honorary Diploma of Fellowship were awarded to Mr. C. E. Borchgrevink in recognition of his leadership of the *Southern Cross* Antarctic Expedition.

Meetings.

The Annual Business Meeting was held on 13th November.

Twenty-three ordinary meetings were held, of which nine were in Edinburgh, six in Glasgow, four in Dundee, and four in Aberdeen. These meetings were addressed by Mr. C. E. Borchgrevink, Mrs. Bullock Workman, Mr. Alfred Sharpe, Major A. St. H. Gibbons, Mr. J. E. S. Moore, Mr. Arthur Gulston, Mr. Alexander Hosie, Major E. J. Medley, and Captain H. H. P. Deasy.

Delegations.

Dr. James Burgess, C.I.E., LL.D., and Mr. Ralph Richardson, W.S., represented the Society at the celebration of the 450th anniversary of the University of Glasgow. Dr. H. R. Mill represented the Society at the Conference of Delegates of Geographical Societies held in London.

The Society's Magazine.

The *Scottish Geographical Magazine* has, as usual, been published monthly throughout the past session.

The Council is glad to acknowledge its obligation to the contributors of articles, and to the following gentlemen who have rendered valuable assistance to the Editors :—Hon. J. Abercromby, Colonel Bailey, J. G. Bartholomew, W. B. Blaikie, W. S. Bruce, H. M. Cadell, Rev. Hugh Callan, S. H. F. Capenny, E. K. Carmichael, C. G. Cash, James Chumley, James Currie, W. S. Dickson, Dr. R. W. Felkin, H. B. Finlay, D. P. Heatley, Dr. A. J. Herbertson, Prof. C. G. Knott, Dr. J. W. M'Crindle, Sir John Murray, J. R. Reid, Ralph Richardson, Dr. J. Y. Simpson, Dr. George Smith, W. A. Taylor, and W. B. Wilson.

Library and Map Department.

During the past session 310 books, 84 pamphlets, 98 reports, 20 atlases, 318 map-sheets, and 17 charts have been added to the library; and three new exchanges have been arranged. The number of volumes borrowed by members was 1808, and the library was much consulted by non-members in search of information on special points. The expenses of the library, including cost of binding, amounted to £15, 17s. 8d. A complete set of the volumes of the *Magazine* was presented to the Oxford School of Geography.

The Council desires to record its thanks to foreign and colonial governments for the official publications they have presented to the library; and also to the Royal Geographical Society, and the undermentioned private donors of books and maps:—The Prince of Monaco, Dr. Gunnar Anderson, J. M. Bell, Surgeon-Major W. G. Black, Professor Crum Brown, Lady Chalmers, Dr. David Christison, Dr. Credner, General A. W. Greely, Lady Holdich, W. P. Jervis, Wm. Marwick, Dr. F. P. Moreno, Dr. Otto Nordenskjöld, Mrs. Hugh Rose, General Sir Henry Smith, Dr. George Smith, James Stirling, and J. S. Warden.

The Society's rooms were closed during August for cleaning.

Scottish Antarctic Expedition Fund.

The following additions to the fund have been received during the year, viz.:—

Hon. John Abercromby,	£10 0 0
Through Miss Jane Hay,	3 10 0

The Council is ready to receive further subscriptions towards this important national object.

The Society's Branches.

The Council has again the pleasure to acknowledge the services rendered by the honorary officials of the branches at Glasgow, Dundee, and Aberdeen.

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